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WORKING PAPER

POOR RURAL HOUSEHOLDS, TECHNICAL CHANGE, AND INCOME DISTRIBUTION IN DEVELOPING COUNTRIES: TWO CASE STUDIES FROM WEST AFRICA

by
Peter Matlon, Thomas Eponou, Steven Franzel, Derek Byerlee and Doyle Baker

Working Paper No. 29 August 1979

Department of Agricultural Economics
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by

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FOREWARD

The African Rural Economy Program was established in 1976 as an activity of Michigan State University's Department of Agricultural Economics. The African Rural Economy Program is a sucessor to the African Rural Employment Research Network which functioned over the 1971-76 period.

The primary mission of the African Rural Economy Program is to further comparative analysis of the development process in Africa with emphasis on both micro and macro level research on the rural economy. The research program is carried out by faculty and students in the Department of Agricultural Economics in cooperation with researchers in African universities and government agencies. Specific examples of ongoing research are "Poor Rural Households, Income Distribution and Technical Change in Sierra Leone and Nigeria," "Rural and Urban Small-Scale Industry in West Africa," "Dynamics of Female Participation in the Economic Development Process in West Africa," and "The Economies of Small Farmer Production and Marketing Systems in the Sahelian Zone of West Africa."

Carl K. Eicher
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I. INTRODUCTION

Objectives of the Study

The absolute size of the income gap separating rich and poor has widened substantially in all but a few developing countries during the past two decades. In spite of emerging national commitments towards more broadly based growth, efforts to reduce poverty and relative income inequality have been hindered by insufficient knowledge of how to design policies which ensure broad participation, how to implement them, and how to measure their impact. Underlying these policy questions is a general paucity of information on incomes, on the occupational and demographic characteristics of the poor, and on how the poor respond to and are affected by alternative development policies. The Poor Rural Households Project, of which this study is one component, was designed to contribute to a better understanding of how the distribution of rural income is affected in the process of development and to indicate the kinds of policies and institutional changes necessary to ensure a more equitable pattern of growth.

Four characteristics of the Sierra Leone and Nigerian study areas examined in this research should be singled out to understand the unique contribution of the Michigan State component in meeting these objectives:

First, although some regional variation occurs, West Africa is marked by relatively high land/man ratios and generally egalitarian systems of land tenure. As a result, landlessness is uncommon. Since the rural poor are generally small farmers with secure land tenure, programs of land redistribution and job creation to absorb landless workers may have somewhat

less relevance compared with the Latin American and Asian Environments.

A second important aspect of the region is that the degree of technical change in agriculture has been very limited. National research institutions inherited from the colonial period have not achieved the quantum improvements in seed/fertilizer technologies which have been developed for South Asia and for parts of Latin America. Thus there is very limited and typically highly localized experience with which to conduct ex post analyses of the impacts of technological change. On the other hand, investment in physical and biological research in the area has risen rapidly during the past decade. This places priority on identifying the constraints on production among low income farmers in order to contribute in the ex ante design of more appropriate interventions.

The third important characteristic of the region is that mean incomes are very low and levels of infrastructural and institutional development (educational, health, marketing, transport, etc.) are with few exceptions generally below those of most developing countries in Latin America or Asia [World Bank, 1978a]. The economies of the region are dominated by the rural sector with 60 to 90 percent of the work force employed in agriculture. Literacy rates are among the lowest in the developing world and infant mortality rates are among the highest. Included among the 34 poorest developing countries according to World Bank figures (low income countries with GNP per capita of $250 or less) are 19 nations of sub-Saharan Africa. These indicators are important for two reasons. First, they point to the likelihood that substantial proportions of the population are at risk of falling into absolute poverty, unable to meet

even minimum basic needs. Second, the low level around which incomes vary points to the particularly limited impact which domestic income transfers might have in improving the living standards of the rural poor.

A fourth characteristic of the region is the extreme paucity of information at the household level. Among the areas of the developing world, least is know about the size distribution and structure of personal incomes in Africa. The available data tend to be highly aggregated and have been used primarily to estimate national averages and to compare administrative regions or industrial categories. In very few instances are data available to examine the interpersonal distribution of income, or changes in distribution over time. Moreover, coverage is almost exclusively limited to the modern urban sector.[1]

These characteristics--continued availability of land, limited technical change, low mean incomes, and limited data--were the basis upon which the objectives of the present study were formulated. If interventions are to be designed to help the rural poor, an improved understanding of the current distribution is essential. Detailed information is needed on the characteristics of households at various income levels--their control of resources, patterns of resource allocation, and levels of productivity--in order to identify the constraints limiting incomes. Finally, such

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[1]Among 12 African nations for which estimates of national income distribution are available, only three of these include information on the interpersonal distribution within their rural sectors--Botswana, Tanzania, and Uganda. See Jain [1975] and van Ginneken [1976].

knowledge must be disaggregated by income strata if interventions addressing the needs of a broad spectrum of households, in particular those of the extreme poor, can be developed.

Rural Incomes, Technical Change, and The National Distribution

Before presenting the conceptual framework which guided this study, it is useful to place the analysis of rural incomes into a broader national context. In view of the weak empirical base, it is not surprising that the dynamic interaction between development and income distribution is not yet well understood. Numerous authors have concluded from cross-country evidence that economic growth is accompanied by an initial period of increasing national inequality followed by a tendency towards a more equal distribution [Kuznets, 1955, 1963; Paukert, 1973; Adelman and Morris, 1973; Ahluwalia, 1976]. A common model used to explain this pattern relies upon inter-sectoral income differentials and changes in the national economic structure which occur as part of the growth process. The model's dynamic force is a more rapid growth of personal incomes within the industrial sector accompanied by a shift of population out of the rural areas into industrial employment. Although national inequality is amplified if incomes are less equally distributed within industry, the model suggests that the primary cuase of national inequality is the income gap between the agricultural and industrial sectors, rather than disparities within either sector.

The general validity of the inter-sectoral model, however, has been challenged by decomposition analyses which separate national inequality

into inter-sectoral and intra-sectoral components [van Ginnekan, 1976; Fields and Schultz, 1977; Fishlow, 1972]. Among the developing countries examined, inequality between sectors has typically been found to explain less than one third of overall national inequality, with the greatest proportion attributable to within-sector disparities. It is particularly important that in a number of low income countries representing a range of development stages, inequality within rural areas has been found to explain a greater proportion of national inequality than either urban or inter-sectoral disparities [van Ginnekan, 1976].

Rural inequality reflects both the emergence of economic dualism within agriculture--that is, the growth of small, modern agricultural sub-sectors characterized by the application of new production techniques within a larger, less productive, and lower income traditional sector [Oshima, 1973]--and the "pre-growth" distribution of income among traditional farming households. Both sets of factors are by nature closely interrelated. Experience in countries which have witnessed the rapid spread of improved bio-chemical technologies has shown that the pattern of adoption can be importantly affected by the existing distribution of resources and incomes [Ruttan, 1977]. Thus if successful adoption requires increased use of factors which are positively related to current income, such as human or physical capital, or if access to modern inputs is influenced by institutional structures similarly related to income, a skewed traditional distribution will both retard modern sector expansion and contribute to greater inequality over time.

These relationships again highlight the need for detailed knowledge of the current distribution of resources and incomes at the household

level. Such information combined with an understanding of the factor requirements implicit in new production packages can assist in predicting adoption patterns and their distributional effects. More important is the ex ante contribution micro-level analysis provides in the design of interventions which are compatiable with the circumstances of the rural poor.

Conceptual Framework for the Study

Within most of rural Africa resources are controlled and allocated by working members of the household firm to meet the consumption objectives of the larger family unit. Thus, in examining the distribution and determinants of personal income, the household has been taken as the primary unit of analysis.[1] The household can be viewed as two overlapping components: the production unit, defined as the working members of the household together with their productive assets; and, the larger consumption unit which consists of all household members both active and inactive among whom the household product is shared. Although production and consumption decisions are often more fragmented in large extended families, major decisions in both areas are generally centered in the head of household.

It follows that with respect to the distribution of personal income two relationships are critical: (1) the level of household income generated by the production unit; and (2) the size of the consumption unit

---

[1]The household has been operationally defined as those persons dependent upon a common source of food for the greater part of the year.

relative to the production unit. Combined, these determine the consumption level available to individual household members. Most studies examining personal income determinants have concentrated on factors affecting production, and indeed this study also gives primary emphasis to production relationships. However, it is also hypothesized that within the African rural environment, characterized by low population pressure and family oriented handtool production systems, the composition of the household--that is, the number of workers relative to the number of consumers--may also importantly influence levels of personal income. Moreover, to the extent that this ratio varies systematically with the stage of family development, life-cycle determinants are hypothesized to explain at least part of the income distribution at any given point in time.

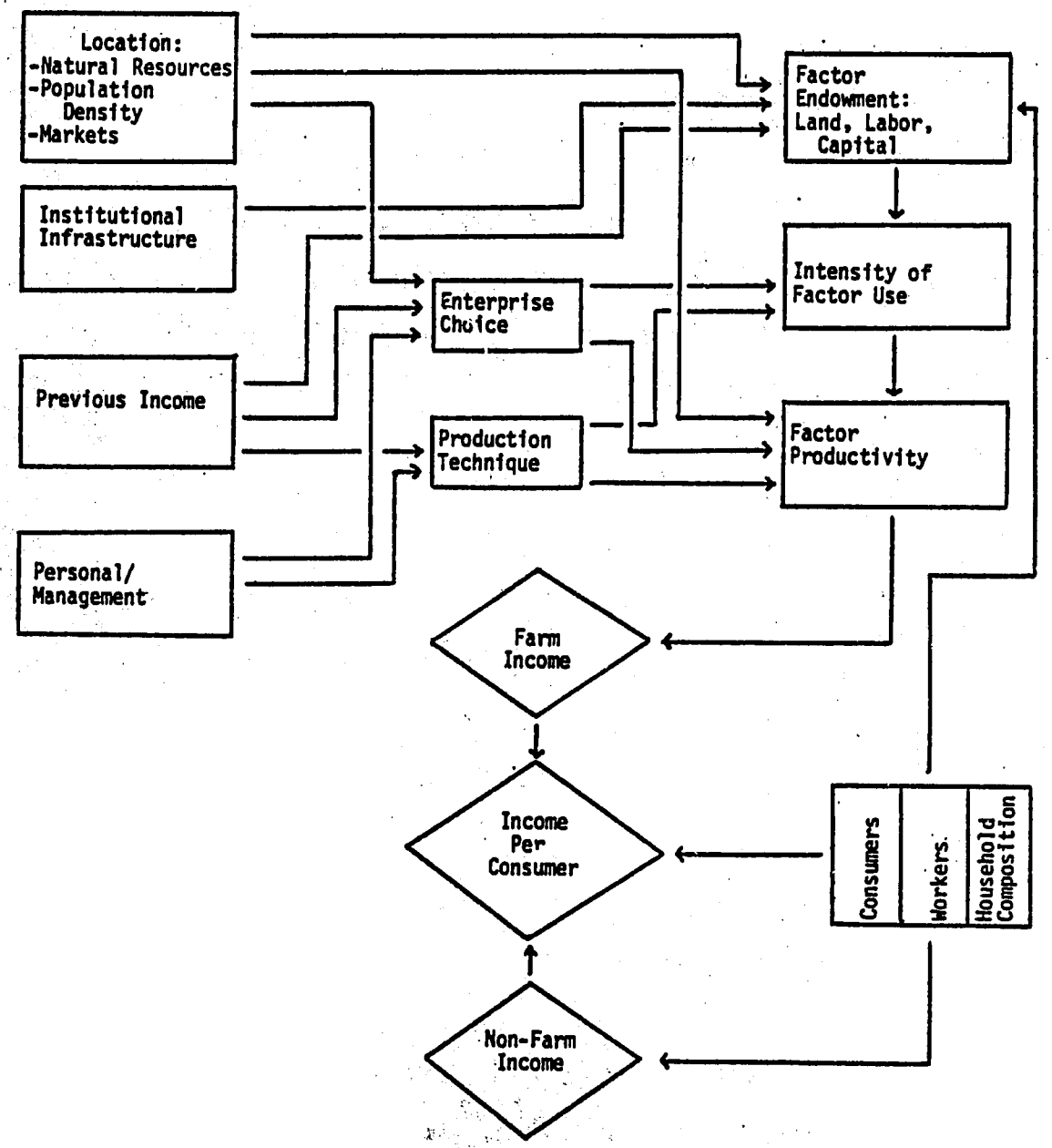
Inter-household Variation in Production

Figure 1 presents a simple diagram depicting the interaction of supply factors which determine household incomes. Although a breakdown of production determinants is shown only for the farm sector, a parallel but distinct set is assumed to apply to the non-farm sector as well. As presented, production levels are a function of three general sets of determininants:

1. The quantity of the household's factor endowment. This includes the available land base, size of the household work force, and access to capital.

2. The level of intensity at which factors are used. Included are land area actually cultivated, levels of use of both fixed and working capital, and hours of employment of the household labor force.

Figure 1.1 SCHEMATIC DEPICTING SUPPLY FACTORS WHICH AFFECT INCOME GENERATION AMONG FARMING HOUSEHOLDS IN AFRICA



3. Factor productivity as measured in returns to land, labor and capital. These reflect both allocative and technical efficiency and are determined by qualitative differences in (1) and factor interactions in (2).

The income of any particular household is uniquely determined by the specific values attained at each level. For example, a household may fall into poverty due to an acute land shortage despite intensive use of its limited resources and adequate returns to land. Alternatively, a household's poverty status may be due to low productivity in the face of adequate land and labor and average levels of factor use. The important point is that the pattern of these factors among the population determines the ultimate distribution of generated incomes. It is clear that for policy purposes an understanding of the relative importance and distribution of each set is critical since each implies a distinct policy approach.

As depicted in Figure 1, factor endowment, use and productivity are further determined by a set of exogenous variables which can be grouped as follows:

1. Location with respect to ecological factors. Variation in soils and climate affect both the selection of farm enterprises and the subsequent profitability of those enterprises. Population density determines inter-regional variation in the access to and cost of both land and labor as well as current soil quality.

2. Location with respect to markets. Inter-household differences in ease of access to markets influence product and factor prices and the availability of purchased inputs.

3. Institutions. Village institutions which define the local political economy may further influence access to product and input markets and to government services, as well as the cost of both variable and fixed resources.

4. Wealth/Income from previous periods. Wealth and savings brought forward from previous production periods influences the household's current production strategy by permitting higher income households to engage in enterprises which require higher capital inputs or which involve greater risk but which may have higher expected returns.

5. Personal Preferences/Management. Work preferences and taste may influence the level of employment, choice of technique and choice of enterprise. Moreover, inter-household variation in management quality may result in substantial differences in production efficiency.

The approach taken in this research is to examine the extent to which income variation is explained by corresponding variation in factor endowment, factor use and/or factor productivity and to indentify how each of these general determinants varies in importance among income strata. Particular emphasis is placed on each of these aspects among the poorest rural households. Additional analysis is directed at explaining variation in these general determinants as a function of the second set of more specific relationships presented above. In this way, we can arrive at a better understanding of aggregate patterns of income distribution, while constructing profiles of households--including both structural and behavioral characteristics--at each level of the income distribution.

It is important to note that by concentrating on production and incomes at the household level, we have generally limited our analysis to factors on the supply side which affect personal incomes in the study areas. That is, prices and the underlying demand structure have been taken as constants. It is clear that with changes in the demand for both rural products and factors--either in domestic or international markets--a dynamic price structure can exert a profound influence on the levels and distribution of rural incomes over time. Demand factors outside of the rural sector are not explicitly considered in this report.

Finally, the household perspective is broadened by selectively drawing on the results of previous studies conducted in Sierra Leone. In particular, rural consumption patterns are reviewed to derive how changes in the level or in the distribution of rural incomes will affect production and incomes within rural or urban areas. Labor migration flows are also reviewed to indentify the potential of labor mobility as a means of equilibrating regional income differences and to determine how current migration patterns affect intra-sectoral income disparities.

II. AN OVERVIEW OF THE STUDY AREAS AND DATA SOURCES

Sierra Leone

The Economy

With a population of 3.05 million, Sierra Leone is a relatively small West African country ranking 32nd of 54 countries in Africa in terms of size. Sierra Leone's per capita Gross National Product during 1976 was estimated at $193 placing it 37th within Africa, and including it among the 25 poorest nations of the world according to World Bank figures. Moreover, recent growth in real per capita GNP has been poor, falling from an annual rate of 1.3 percent during 1960-70 to -.5 percent during the period 1970-76 [World Bank, 1978a, 1978b].

Similar to most developing countries, the Sierra Leone economy is dominated by the rural sector. In 1976 approximately 84 percent of the population was living in rural areas with roughly 69 percent of the work force employed in agriculture. Although this represents a decrease in the proportion of the work force in agriculture from 78 percent in 1960, the absolute number of persons in agriculture is estimated to have increased by more than 60 percent during the period. This reflects the continued role of the rural sector in absorbing the bulk of national population growth estimated at 2.5 percent annually during the 1970s.

Growth in agricultural output has remained below population growth, averaging an annual rate of 1.4 percent during the 1960s and 2.0 percent in the period 1970-76. These rates compare with national real GDP growth of 3.5 percent experienced during 1960-70 and 2.0 percent observed in the 1970s. Due to these differential rates of growth, the structural

composition of the economy has changed substantially during the past two decades. Since 1960 the share of agriculture has fallen from roughly 40 to 32 percent, industry has declined from 32 to 23 percent, while the most rapid growth has been evident in the services sector which expanded its share from 29 to 45 percent of GNP.

Although data on the distribution of personal incomes are not available either by sector or within sectors to measure the effect of these structural changes on overall national inequality, it is clear that the agricultural population has lost in relative terms. Between 1960 and 1976, for example, per capita GNP in agriculture is estimated to have remained nearly constant at approximately $85. This compares with an average increase in per capita GNP during the same period of from roughly $160 to $193 for all sectors.

The Sierra Leone government has reacted to the poor performance in agriculture by substantially increasing development expenditures in that sector. Between 1963-64 and 1970-71 agriculture's share of the development budget increased from 4 to 11 percent and was projected to rise to nearly 26 percent during the 1974-75 to 1978-79 plan period [Government of Sierra Leone, 1974]. Particular emphasis in that plan was given to the production of rice, the dominant staple of the country. Since the early 1950s, Sierra Leone has become increasingly dependent on rice imports with imports rising to 43,700 metric tons in 1973, at a cost of 6.1 million Leones.[1] Rice production is being promoted through schemes to develop inland valley swamp rice, such as a set of I.D.A. financed projects in the East and North.

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[1] 1 Leone = 1.10 Dollars at the official exchange rate in 1974-75.

The government also has encouraged mechanical cultivation of rice, and by 1974 the mechanically cultivated area had risen to over 25,000 hectares. Although the plan explicitly sets out as one of its objectives a more equitable distribution of income and wealth, the impact of these policies on intra-sectoral income patterns is not known.

Characteristics of Rural Regions

Sierra Leone contains a range of ecological conditions which importantly influence the geographic distribution of income. For purposes of sampling, eight resource regions were defined based on variation in soils and climate [Mitra, 1971]. To simplify analysis and presentation, these have been grouped into three more general regions--the South, East, and North--retaining the essential ecological characteristics of the original resource regions. These are shown in Table 2.1 and Figure 2.1.[1]

Rainfall declines as one moves from the South to the East and North in Sierra Leone. The region receiving the highest average rainfall is the Riverain Grasslands in the South, with 4064 mm per year, and the driest region is the Northern Plateau with rainfall of 2300 mm declining to 1800 mm on the eastern extreme. The wet season generally lasts from May to December, but increases in duration in the southeastern portions of the country. The distribution of rainfall is most favorable in the East with a longer growing season which is well suited to coffee and cocoa. Vegetation varies with the distribution of rainfall. Savannah

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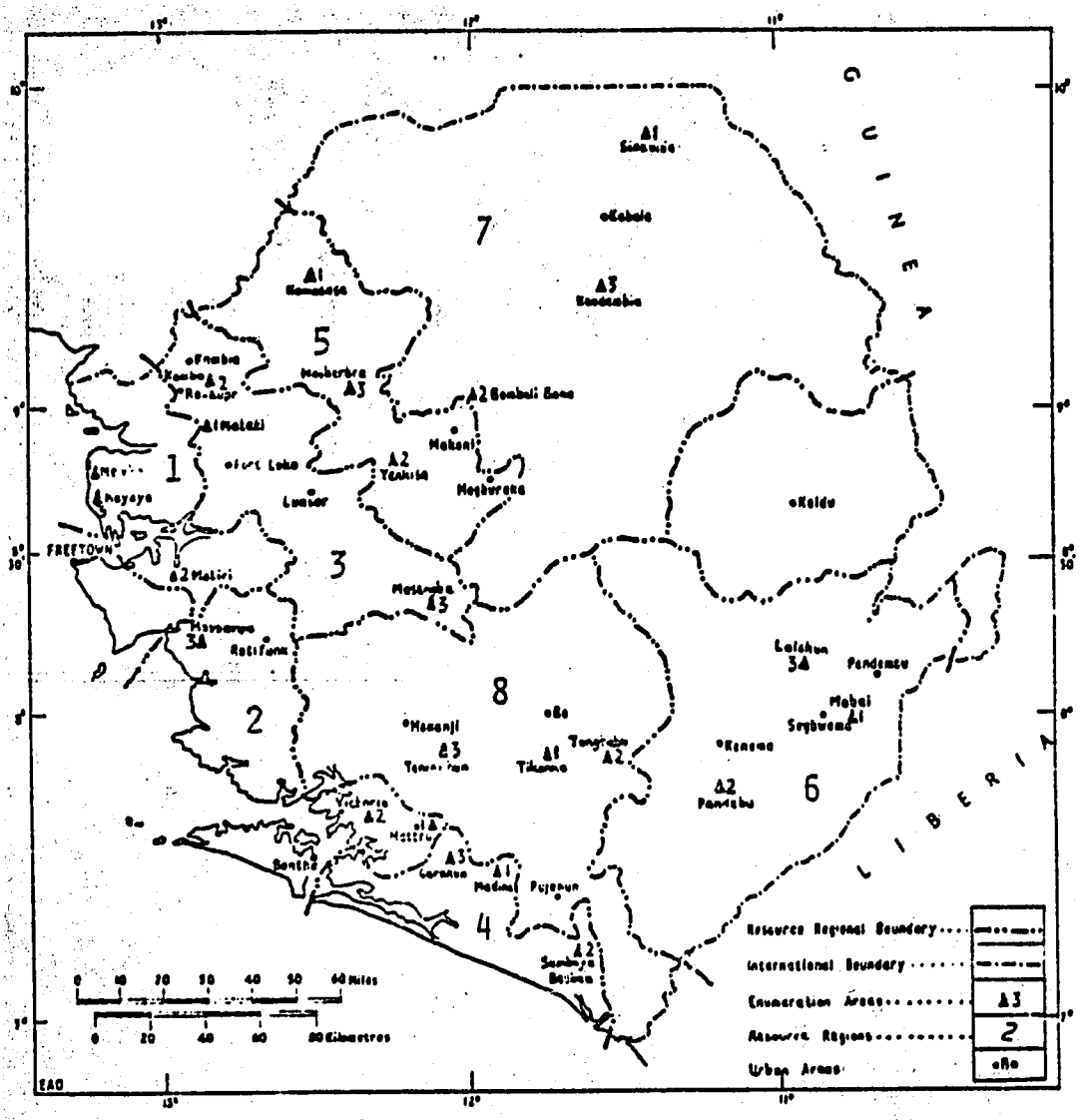
[1]Characteristics of the Nigerian study area examined in this report are also presented in Table 2.1 for comparison.

Figure 2.1 SIERRA LEONE RURAL RESOURCE REGIONS[a]



South	North	East
Southern Coast (2)	Scarcies (1)	Moa Basin (6)
Riverain Grasslands (4)	Northern Plains (3)	
Southern Plains (8)	Boliland (5)	
	Northern Plateau (7)	

[a]Spencer, Dunstan S.C. and Byerlee, Derek. 1977. "Small Farms in West Africa: A Descriptive Analysis of Employment, Incomes and Productivity in Sierra Leone." African Rural Economy Working Paper No. 19, Department of Agricultural Economics, Michigan State University, East Lansing, Michigan.

Table 2.1 ECOLOGICAL AND DEMOGRAPHIC CHARACTERISTICS OF RURAL RESOURCE REGIONS IN SIERRA LEONE AND NIGERIA

Region	Area (km^2)	Population (1000)	Rural Population Density (Persons per km^2)	Elevation (meters above sea level)	Mean Rainfall (mm)	Vegetation	Soils	Dominant Ethnic Group	Average Household Size	Primary School Attendance[a] (percent)
SIERRA LEONE	68,876	1,824.2	26.5	0-400	-	-	-	-	6.4	24.2
North	39,104	884.3	22.6	0-400	-	-	-	-	6.8	16.2
Scarcies	2,412	156.9	65.0	<15	2540-3550	Chesnapodium grass Mangrove swamps Inland swamps	Reddish to yellow brown Laterite	Temne Susu	8.7	20.2
Northern Plains	5,769	277.6	48.1	15-150	2540-3800	Lophita Grass savannah Secondary bush	Laterite	Temne	7.3	11.3
Bolilands	4,614	172.2	37.3	15-150	2400-3550	Savannah Swamp grasslands Secondary bush	Laterite	Temne Limba Loko	8.1	13.0
Northern Plateau	26,308	277.6	10.6	300-400	<2000-3550	Savannah	Reddish brown Laterite	Limba Fullah Koranko	6.3	17.4
South	17,772	473.7	26.7	0-150	-	-	-	-	5.5	37.4
Southern Coast	3,420	94.9	27.7	<15	2800-4060	Secondary bush Mangrove swamps Inland swamps	Laterite Lithosols Alluvial	Mende Temne	6.4	20.8
Riverain Grass-lands	2,759	56.6	20.5	<15	3300-4600	Grasslands Secondary forest	Alluvial	Mende	4.7	22.5
Southern Plains	11,593	322.2	27.8	15-150	2660-3550	Secondary forest	Laterite	Mende	5.4	45.9
East (Moa Basin)	12,003	466.2	38.8	150-300	2540-3556	High Bush	Laterite	Mende	5.1	31.0
NIGERIA (Kano State)[b]	261	13.1	50.2	500	880	Savannah grasslands	Brownish red Laterite	Hausa	6.7	6.0

[a]Percent of children 6 to 16 years of age attending school in rural areas.

[b]Figures represent 3 study villages only, not Kano State as a whole.

grasslands dominate in the drier North while secondary forest and bush are more common in the South and East.

Sierra Leone as a whole has a population density of 41 persons per square kilometer and a rural population density of 27 persons per square kilometer, figures which are somewhat high by African standards. The Freetown peninsula in the West and the coastal swamp lands in the Scarcies are the two most densely populated areas. The lowest population pressure is found in the Northern Plateau and Riverain Grasslands.

Socio-demographic characteristics of the population also vary importantly by region. The population in the South is predominantly of the Mendi ethnic group while the North is populated by the Temme, Limba, and other smaller ethnic groups. Correlated with the ethnic variation are differences in average household size with households somewhat larger in the North. As is pointed out later, this has important implications for inter-regional variation in farm size and household incomes. School attendance is generally higher in the South, while traditional Arabic training is more common in the North. Other social services including health facilities and extension assistance, as well as the road network, are also somewhat better developed in the South.

Rice cultivation forms the basis of most farming systems throughout Sierra Leone. Grown by nearly 90 percent of all farmers, rice occupies 58 percent of cultivated area, and accounts for nearly 50 percent of the value of farm output nationally. Five major rice growing systems can be distinguished [Spencer, 1975]: upland, inland swamp, boliland, mangrove, and riverain. Upland rice predominates in most regions of the country representing approximately two-thirds of the nation's total rice production.

Wild oil palm is the second most important crop enterprise and is particularly important in southern and northwestern regions. Coffee and cocoa, grown primarily in the East, follow oil palm in order of importance as tree crops. Onion, peppers, tomatoes and other vegetables are also important cash crops with cultivation centered about the urban markets in Kabala in the North and Freetown. In addition to rice, the most important food crops are groundnut, cassava, and fundi (digitaria exilis). Groundnut is cultivated throughout the country, while cassava is concentrated in the South, and fundi in the North.

As is the case throughout West Africa, small farmers using low levels of technology form the backbone of Sierra Leone agriculture. Average family size is 6.4 persons cultivating 2.7 hectares, typically in a bush fallow system. Since the average period over which land is left in fallow is approximately 10 years, this implies that the average farmer actually controls about 16 hectares. Most land is communally owned, either by the community (chiefdom) or by a family group. Transfers among families or to strangers entering a chiefdom are typically accompanied by a nominal fee. The average payment made for transfer of farm use rights amounted to approximately Le 2 ($2.20) per hectare.

Annual capital costs in farm production are low, averaging about Le 2.50 ($2.75) per household, and consist primarily of the depreciation of hand implements. Mechanized cultivation is practiced on less than 3 percent of the cultivated area nationally and is concentrated in the Bolilands and Riverain Grasslands regions. The use of improved bio-chemical technology is also minimal with less than 3 percent of farmers applying chemical

fertilizers. Eighty-five percent of total farm labor is provided by household members.

Nigeria

An Overview of the Economy

During the past decade, Nigeria has emerged as a dominant economic power in sub-Saharan Africa. With a population estimated at 77 million Nigeria is the largest country in Africa and includes 23 percent of the continent's entire population [World Bank, 1978b]. While its aggregate gross national product of 30.9 billion in 1976 ranked second in Africa (behind South Africa), due to its large population its GNP per capita was only $400, or 18th in Africa as a whole [World Bank, 1978a].

Growth of the Nigerian economy has been particularly rapid during the past decade. Fueled by a boom in petroleum exports, the GNP is estimated to have increased between 1970 and 1976 at a real annual rate of 7.4 percent, and GNP per capita at an annual rate of 5.4 percent. Accompanying this growth, income disparities are believed to have widened substantially. Although the magnitude of intra-sectoral disparties is not fully known, disparities between the rural and urban sectors are substantial. During 1964-65 agriculture accounted for 58 percent of GDP and employed 70 percent of the active work force [Federal Republic of Nigeria, 1975]. By 1974-75 agriculture's share in GDP had fallen to only 23 percent while the proportion of the labor force remained relatively high at 64 percent. In contrast, during the same period the petroleum and mining sector increased its share of GDP from 3 percent to 46 percent, while its proportion of total employment remained below 1 percent.

These changes in sectoral composition reflect not only rapid growth in the non-farm sectors, but stagnancy in agriculture as well. Between 1970 and 1976 total farm output fell at an annual rate of -0.2 percent. This is partly the result of the Sahelian drought which affected the northern regions of Nigeria, but is also due to the rapidly increasing demand for labor in other sectors. This contrasts with an average annual growth of 12.6 percent in industry and 9.5 percent in services during the 1970-76 period. The petroleum and mining sector accounted for a large part of the non-agricultural growth with an average annual rate of increase of approximately 25 percent.

The resulting income disparities between sectors have been substantial. Between 1970 and 1975 per capita GDP measured in constant 1974-75 prices in agriculture is estimated to have remained nearly constant at approximately ₦ 61 ($100) per capita compared with an increase in the national average of from ₦ 137 ($225) to ₦ 189 ($310) [Federal Republic of Nigeria, 1975].[1] Per capita farm incomes, therefore, declined from roughly 45 percent to 32 percent of the national average. Moreover, relative to per capita GDP in all non-farm sectors, average agricultural output per capita fell from approximately 34 percent to only 22 percent during the first five years of this decade.

Although information on intra-sectoral distributions are inadequate to permit a direct analysis of how these structural changes have affected the national distribution, the rough magnitude of recent changes in the

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[1]The official exchange rate during 1975 was 1 Naira = $1.64.

national distribution has been estimated by Byerlee using an input-output model of the Nigerian economy [Byerlee, 1973]. With development policies unchanged from the Second National Plan, it was projected that structural changes in the Nigerian economy would increase the national Gini ratio from a base of .49 in 1970 to .64 by 1983. Even assuming the most optimistic national policies--balanced food and export promotion combined with lower non-agricultural wage rates--the Gini ratio was projected to increase during the period to .51.

Official concern with the poor performance in agriculture and the resultant increase in national inequality is clearly present. An immediate cause of concern has been the emergence of substantial food deficits. In recent years grain imports have increased to over one half million tons. And with continued rapid growth in the non-farm sectors, a high income elasticity, and population growing at nearly 3 percent annually, the deficit has been projected to increase to nearly 8 million tons by 1985 [IFPRI, 1976]. To meet estimated food needs by that year, it is estimated that cereal production would have to expand at a rate of 7 percent per year.

In response to this situation several major farm programs have been introduced. These include: (1) a reorganization of the marketing board system to increase producer prices, (2) a National Accelerated Food Production Program involving the distribution of higher yielding crop varieties through a coordinated fertilizer, pesticide, credit package approach, (3) a number of large integrated rural development schemes, (4) investment in state operated large-scale farms, (5) construction of large-scale irrigation projects, and (6) the establishment of agro-service centers

distributing subsidized inputs to small farmers under the auspices of Operation Feed the Nation. Guided by the Plan's corollary objective of inter-personal and inter-regional equity, several of these programs have been given particular emphasis in the northern states of Nigeria where incomes have traditionally remained lowest. The results of these efforts to date, however, have been mixed, and their impact on income distribution within the farm sector is not known.

Characteristics of the Kano Area

Nigeria displays even more varied ecological conditions than Sierra Leone, with average annual rainfall ranging between 3200 mm in the predominantly tropical rainforest zone of the south to only 200 mm in the lake Chad areas of the extreme north. The area selected for the Nigerian survey is located in the Guinea-savannah zone of Kano State in the north of Nigeria. Rainfall in the study area averages approximately 890 mm distributed over a 120-day period generally extending from May until September. During the year in which the survey was conducted, total rainfall was very nearly equal to this long-term mean.

Soils in the area can be divided into two types: upland soils, which comprise over 95 percent of the total land area, and lowland soils, which are generally located near river basins and which can often support dry season farming without supplemental irrigation. The upland soils of the area are well drained and heavily leached brownish-red laterites deficient in both nitrogen and phosporous. It is important that although uncultivated plots of land were in evidence throughout the study area, the practice of incorporating a fallow period into a regular pattern of crop

rotation was not common. The population density of the survey area was estimated to be 50 persons per square kilometer.

Farming units in the study villages were generally representative of households throughout the northern region of Nigeria. The average household consisted of 6.7 persons holding usufructuary rights over 2.4 hectares of cultivated land. Permanent transfer of use rights between households and expansion onto bush lands is done subject to approval of the village head. Eighty percent of all cultivated land in the study area was held through inheritance, purchase, or original clearing, thus reflecting relatively secure tenure status for most households. Only 16 percent of farmed land was being rented, with the remaining held as collateral on loans. Rental rates were nominal, averaging less than N 5 ($8.20) per hectare for upland fields and approximately N 20 ($32.80) per hectare for lowland areas. Although nearly 40 different crops were grown in the area, the basic food staples, millet and sorghum, together with the dominant cash crop, groundnut, represented 75 percent of the total harvest value.

The technology of the local farming system was essentially traditional with only limited use of modern inputs. Chemical fertilizers were applied during the survey year by 40 percent of the sampled households, but at extremely low levels. An improved groundnut variety, highly mixed with traditional varieties, was sown by nearly all of the sample households. However, the yield advantage of this improved groundnut variety was minimal, only 10 to 15 percent greater than local varieties on farmers' fields.

Tractor cultivation was practiced by less than one percent of the sampled households. None used animal traction. Average stocks of farm tools were valued at less than the ₦ 9.00 ($14.75) replacement cost. Fifty-eight percent of farm labor was provided by household members.

Comparison of Sierra Leone and Nigerian Study Areas

The Sierra Leone and Nigerian survey areas display similarities in several important respects. Landlessness among rural households is not a problem in either area. Production is organized around the family farm and practiced at nearly the same scale. Minimal, highly localized mechanical and animal traction use was present and no substantially improved seed varieties were available for distribution to farmers in either area. While chemical fertilizer use was greater in the Nigerian case application levels were consistently low.

The institutional environments of both areas are also essentially similar. Traditional village leadership remains dominant but there is no stable inter-generational class structure based on income or control of assets. Agricultural extension systems are badly understaffed and there has been little organization of farmers' groups for development activities. Land tenure institutions are relatively egalitarian with the communal assignment of usufructuary rights considerably more important than the direct ownership of land. Consequently, the land market is not well developed with land payments typically representing a fraction of the land's value in production.

The ecology, degree of pressure on the land, and farming systems however, present important contrasts. The Sierra Leone case represents a considerably more land extensive bush fallow farming system in comparison

to the continuous cultivation practiced in the higher density Nigerian area. Moreover, since it is based on a nationwide survey, the Sierra Leone study includes a range of high and medium rainfall zones characteristic of the coastal areas of West Africa. In contrast the Nigeria study represents systems primarily characteristic of semi-arid savannah zones. Crop enterprises vary accordingly.

Data Collection

The data upon which this report is based were collected in micro-level rural household surveys conducted in both Sierra Leone and Nigeria during 1974 and 1975.[1] These surveys employed a cost-route technique in which sampled households were regularly visited at frequent intervals for a period of twelve months [Spencer, 1972]. During each interview information relating to the immediate reference period (time since the last interview) was obtained. There was considerable interaction between the Sierra Leone and Nigerian research teams during the design phase of their studies which resulted in highly comparable data sets. However, since the coverage, types of data, and collection methods differed somewhat, it is useful to consider each survey in turn.

Sierra Leone

Sampling Procedure

A two stage stratified sampling procedure was applied in selecting farm households in Sierra Leone. Using available secondary data

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[1]The Sierra Leone survey was financed by an Agency for International Development contract (AID/csd 3625) with the Department of Agricultural Economics at Michigan State University. Data collection for the Nigerian survey was supported by an Agency for International Development contract with Cornell University and conducted while the researcher was a graduate assistant at Cornell.

[Mitra, 1971] the country was first divided into eight resource regions representing distinct ecological zones. The location of each region is shown in Figure 2.1. Each resource region was further subdivided into the enumeration areas used by the Central Statistics Office for the 1963 population census [Government of Sierra Leone, 1965]. All enumeration areas falling into or containing urban areas (defined as localities with more than 2,000 people and more than 50 percent of the labor force primarily engaged in non-farm activities) were rejected. Three enumeration areas were then selected at random to represent each resource region.

Within each enumeration area a census was conducted listing all households to provide a sample frame for selecting the primary units of study. From these lists a stratified sample of twenty farm households and four non-farm households (excluding traders) were selected at random in each area.[1] During the survey some households were dropped from the sample due to deaths and movement from the village. At the time of analysis households with serious problems of missing or inconsistent data were also dropped, reducing the number of households analyzed to 328.

Survey Method

Between March 1974 and June 1975 sampled households were visited twice weekly to collect a range of information through structured interviews. Spencer and Byerlee [1977] provide an overview of the data collection instruments employed summarizing the types of information and frequency

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[1] Farm and non-farm households were distinguished according to what the household head claimed as his primary occupation during the census interview.

of interview associated with each questionnaire. All fields of selected households were measured in the course of the survey. Crop production levels were estimated by both yield-plot and end of year recall methods. Market surveys conducted monthly in each village area and household information on crops sales provided the necessary price data.

Nigeria

Sampling Method

Three villages in southwestern Kano State were selected to satisfy the dual objectives of minimum inter-village variation in soils and climate but maximum variation regarding access to external markets. Located in Karaye district approximately forty miles north of Zaria City and sixty miles southwest of Kano City, the three villages are closely situated within a radius of ten miles. In spite of their proximity, the villages differ importantly with respect to external market access. One large market village (Rogo - population 6405[1]) is located on a major feeder road, and is serviced by daily lorry contact throughout the year. The smallest village (Zoza - population 2964) is located approximately a mile from the nearest feeder road and contact with motorized transport is infrequent. The third village (Barbeji - 3744) is remotely located about eight miles from the nearest highway over paths which are motorable only with great difficulty during the dry season. A more detailed description of village characteristics is contained in Matlon [1979].

The sample frame consisted of all household heads included on updated tax lists obtained in each village. Forty-five households were

[1]Population figures are taken from the 1963 census.

randomly selected from these lists and an additional six households were selected on the basis of special socio-political positions occupied within the villages. The latter group was included in the survey to permit an analysis of the relationships between political position, access to government programs, and income.[1] Based on the results of a situational survey administered to all selected households, the general sample was divided into large sample (between 33 and 35 households per village) and small sample (either 11 or 12 households per village) sets. The total sample size was 140 households, 105 large sample and 35 small.

Survey Method

Depending upon the type of information and sample size, several interview frequencies were employed. The 35 households in the small sample were interviewed two to three times weekly from May 1974 until May 1975 to collect input-output information on all farm enterprises, off-farm employment and earnings, and on consumption expenditures. Weekly interviews were administered to the small sample to collect expenditure and sales data for both farm and off-farm occupations. Large sample households were interviewed at four to five week intervals to obtain identical production, sales, and expenditure data as that obtained from the samll sample. Data describing levels of households labor use, however, were not obtained from the large sample.

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[1]The non-random households included the village heads in two of the survey villages, a hamlet head in one village, and the head farmer (sarkin noma) in each village. Except where specifically mentioned, these political elites are not included in subsequent analysis.

A continuous recall method was used to estimate crop production levels for both large and small samples, complemented by weighings of crop removals in local units. Monthly market surveys in each village and crop sales information provided the necessary price data. As in the Sierra Leone survey, measurements of farm fields were conducted by the survey team. Data collection methods and output valuation procedures are discussed in greater detail in Matlon [1979].

III. INCOMES AND INCOME DISTRIBUTION IN SIERRA LEONE AND NIGERIA

In this chapter, we present income profiles among the sample households in both Sierra Leone and Nigeria.[1] The data are first examined to determine how mean incomes varied by region as well as the degree of income concentration nationally and by region. The location and proportion of households falling into absolute poverty are also identified. The distribution of income is then decomposed by locality and source to identify factors contributing to aggregate patterns of inequality. Finally, labor flows between regions in Sierra Leone are briefly examined to determine the impact of migration on inter-sectoral and intra-sectoral disparities.

Definition of Income

Rural incomes were computed as the return to household land, labor, and management earned in all farm and non-farm occupations. With the exception of female income generated in commercial food processing and petty trading in the Nigerian survey, both studies included earnings generated by all members of the household.[2] Average annual prices, computed regionally, were used to value all inputs and outputs, regardless of final disposition.[3] Loan and gift flows were not included in household

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[1]The analysis presented in this chapter is taken largely from Eponou [1979] and Matlon [1979].

[2]The effect of excluding female incomes in the Nigerian survey is discussed below.

[3]Pricing procedures are detailed in Spencer and Byerlee [1977] and in Matlon [1979].

earnings. Unrealized capital gains which arose from the appreciation of assets during the survey period were also excluded. Incomes were calculated over a twelve month period which coincided with the annual cropping cycle to capture one complete season (May 1974 through May 1975).

In order to make more valid inter-personal comparisons of wellbeing, household incomes were adjusted to take account of variation in the size and composition of household membership by calculating incomes per consumer man-equivalent. The number of consumer units per household was computed by weighting each member by a coefficient representing approximate calorie requirements according to age and sex class [F.A.O., 1957]. Additional marginal adjustments were made to reflect intra-household sharing patterns for non-food consumer goods and to reflect work labor use by age and sex.[1] The coefficients used to calculate consumer units are presented in Table 3.1. The resultant income per consumer measure was used throughout the study to group households into income strata. In order to facilitate comparisons with other studies, per capita figures are also presented where relevant.

Regional Characteristics and Levels of Income

The survey found that the average per capita income in rural Sierra Leone was $103 at official exchange rates during 1974-75 (Table 3.2). The data show that incomes were highest in the South and East of Sierra Leone--a reflection, in part, of more favorable ecological conditions.

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[1]The use of man-equivalent consumer units, and its limitations, have been thoroughly treated in the literature on household budget studies [Woodbury, 1944; Prais and Houthaker, 1955; Kleiman, 1966].

Table 3.1 COEFFICIENTS APPLIED TO ESTIMATE THE NUMBER OF MAN-EQUIVALENT CONSUMER UNITS PER HOUSEHOLD

	Age			
	0-4	5-9	10-15	16+
Male	.2	.5	.75	1.0
Female	.2	.5	.7	.90[a]
				.75[b]

[a]Coefficient applied in the Sierra Leone survey.

[b]Coefficient applied in the Nigerian survey. The lower figure was used to reflect the substantially lower physical work of Nigerian females due to the practice of wife-seclusion.

Table 3.2 MEAN INCOMES AND HOUSEHOLD CHARACTERISTICS IN RURAL SIERRA LEONE AND NIGERIA[a]

Region	Income in Local Currency			Income in Dollars			Cultivated Land		Household Size (persons)	Dependency Ratio[b] (percent)
	Per Household	Per Capita	Per Consumer	Per Household ($)	Per Capita ($)	Per Consumer ($)	Per Household (ha.)	Per Capita (ha.)		
	(In Leone)[c]									
SIERRA LEONE	519	94	120	571	103	132	2.35	.43	6.4	40.1
North	548	78	103	603	86	113	2.50	.35	6.8	46.5
Scarcies	618	72	100	680	79	110	1.86	.23	8.7	51.1
Northern Plains	529	84	106	582	92	117	2.51	.35	7.3	39.0
Bolilands	636	90	117	700	99	129	3.31	.44	8.1	48.7
Northern Plateau	329	60	81	362	66	89	2.28	.39	6.3	49.0
South	498	105	131	548	116	144	2.49	.54	5.5	35.0
Southern Coast	539	99	125	593	109	138	2.21	.39	6.4	38.6
Riverain Grasslands	433	112	138	476	123	152	3.04	.77	4.7	26.2
Southern Plains	519	104	130	571	114	143	2.23	.46	5.4	40.9
East (Moa Basin)	501	107	134	551	118	147	1.50	.36	5.1	36.7
	(In Naira)[d]									
NIGERIA (Kano State)	346	57	83	567	93	136	2.54	.44	6.7	43.9
Rogo	362	54	75	594	89	123	1.88	.30	7.8	45.6
Zoza	319	59	86	523	97	141	2.68	.51	5.7	43.9
Barbeji	359	58	86	589	95	141	3.00	.50	6.6	42.5

[a]All statistics have been calculated as simple averages using households as units of observation. Figures presented for the Nigeria study elsewhere [Matlon, 1977, 1978, 1979] were computed as weighted means.

[b]The ratio of persons less than 16 and greater than 65 years of age to total household size.

[c]Le 1.00 = U.S. $1.10 during 1974/75 at the official exchange rate.

[d]N 1.00 = U.S. $1.64 during 1974/75 at the official exchange rate.

Source: Survey Data

The resource region receiving the least rainfall, the Northern Plateau, was the poorest area according to all measures. The data also suggest that inter-regional variation in household demographic characteristics and land availability may have further contributed to regional income differentials. Households were consistently larger and characterized by less favorable dependency ratios in the poorer North. While the average size of cultivated land per household in the North was somewhat greater than the national average, due to larger family size the area farmed per capita was consistently lower in each of the northern resource regions with the exception of the Bolilands. Cultivated area was largest in the Riverain Grasslands, the highest income resource region in the South, and in the Bolilands, the highest income area of the North. Moreover, within both of these regions there were important areas of mechanically cultivated rice suggesting that greater access to land combined with land extensive technology may have contributed to their higher mean incomes.

Due in part to less favorable ecological conditions, the average per capita income in Nigeria--$95--was less than the national mean for rural Sierra Leone. It is notable that Nigerian incomes were most similar to incomes obtained in Sierra Leone's northern regions, a reflection of the similar ecological conditions of the two areas. Among the three Nigerian study villages incomes were lowest in the large market village of Rogo. The data suggest that this was due in part to greater land pressure in that village.

Sources of Rural Income

Typical of conditions throughout West Africa, most rural households in Sierra Leone and Nigeria were engaged in several income generating

activities. Seven general sources of income have been defined by grouping a range of farm and non-farm enterprises:

1. Annual Crops - This set of activities includes production of annual food grains, legumes, vegetables, and root crops.

2. Tree Crops - Not important in the Nigerian sample, in Sierra Leone these include coffee, cocoa, and wild oil palm.

3. Small-Scale Industries - Included are occupations such as blacksmithing, carpentry, textile production, mat weaving, etc.

4. Natural Resources - Grouped into this enterprise set are hunting, gathering, and fishing, with fishing the most important with respect to income generation.

5. Livestock - This includes all household activities dealing with animal breeding. It should be noted that pastoral groups were not included in either the Sierra Leone or Nigeria surveys.

6. Labor Sold Out - This set includes the provision of household labor for both agricultural and non-agricultural employment off the farm.

7. Trading - This includes the purchase for resale of any farm or non-farm items, including crops. It should be noted that the sampling procedure employed in Sierra Leone systematically excluded households in which a major part of their income was derived from trading, thus the importance of trading as a source of rural income is understated by these data in Sierra Leone.

Table 3.3 shows that nationally in Sierra Leone, farm activities generated 81 percent of rural incomes, compared with 72 percent in the Nigeria study area. Regionally, the greatest dependence on non-farm

Table 3.3 THE PERCENT OF RURAL INCOME DERIVED BY OCCUPATIONAL SOURCE IN SIERRA LEONE AND NIGERIA

Region	Annual Crops	Tree Crops	Small-Scale Industries	Natural Resources	Livestock	Trading	Labor Sold Out	Total
SIERRA LEONE	62.1	19.1	5.6	8.2	.1	0.8	4.9	100
North	70.2	6.7	6.2	11.7	.2	0.9	4.3	100
Scarcies	55.5	2.8	5.1	35.2	.2	0.4	0.8	100
No. Plains	70.8	11.1	10.3	1.0	.2	1.8	4.4	100
Bolilands	83.6	4.1	2.3	1.1	.1	0.1	7.9	100
No. Plateau	69.4	13.7	8.9	0.7	.7	1.0	5.2	100
South	57.2	25.2	4.7	6.4	-	0.6	5.9	100
So. Coast	50.3	32.2	5.2	3.6	-	1.3	7.6	100
Riverain Grasslands	56.8	28.1	3.0	10.1	-	-	2.7	100
So. Plains	67.3	12.2	6.1	7.0	-	-	7.5	100
East (Moa Basin)	49.2	37.8	7.7	1.0	.2	1.1	2.2	100
NIGERIA	70.6	1.2	6.3	0.6	1.1	10.2	10.0	100

Source: Survey Data

income is reflected in the poorer North where only 77 percent of income was earned in cropping enterprises compared with 82 and 87 percent in the South and East, respectively.

Annual crops represent the principal source of income in rural Sierra Leone providing 62 percent of incomes, although the proportion varies significantly across regions. Annual crops were most important in the Bolilands (84 percent), an area in which mechanized rice production is practiced, and least important in the Moa Basin (47 percent), an area specializing in the production of coffee and cocoa. Tree crops ranked second in importance in the humid South where they represented 25 percent of incomes, and were least important in the less favorable North at only 7 percent.

The natural resources, in particular fishing, showed the widest regional variation, reflecting localized specialization derived from proximity to the coast and rivers. While natural resources were most important in the North, representing 12 percent of incomes, this was due to the considerable importance of fishing in the Scarcies region where this activity generated 35 percent of incomes. Small-scale industries provided 6 percent of rural incomes in Sierra Leone as a whole, and showed little regional variation.

Comparing the sources of rural incomes in the Nigeria survey with these patterns in Sierra Leone, several points merit mention. Tree crops were relatively unimportant in each of the Nigeria villages and were limited primarily to baobob and locust bean. Similarly, hunting, gathering, and fishing were also of minor importance. In contrast, trading incomes were substantially more important among the surveyed Nigerian

households comprising more than 10 percent of incomes compared to less than one percent among the sampled Sierra Leone households.

The Distribution of Rural Income

Several measures of income inequality for both case studies are presented in Table 3.4. In addition to showing the shares of income by strata, three summary indexes have been calculated--the Gini ratio, the coefficient of variation, and the standard deviation of the natural log of income.[1] Each measure has been selected due to its sensitivity to various types of inequality. The coefficient of variation is particularly effective in distinguishing among distributions where greater weight is given to differentials in the high income range. In contrast, the log measure gives greater weight to incomes in the lower range and is thus more appropriate for purposes of ranking where priority is given to the incidence of relative poverty. The most commonly used index, the Gini ratio, is more sensitive to differentials in the broad middle income range.[2]

Each measure of national inequality shows that rural incomes in Sierra Leone were generally within the range of equality displayed in other African countries. A Gini coefficient of .38 was calculated on

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[1]Larger numbers for each measure reflect greater inequality. These measures are defined mathematically in Appendix A.

[2]It should be noted that the income strata presented in this and all subsequent tables have been defined by grouping households in ascending order according to their mean income per consumer. As a result each decile contains 10 percent of the sampled household though not necessarily 10 percent of the population due to variation in household size.

Table 3.4 RURAL INCOME DISTRIBUTION BY REGION IN SIERRA LEONE AND NIGERIA

Income Class[a]		Percentage Share of Income														
		Sierra Leone											Nigeria			
		North					South				East	National				
Tercile	Decile	Scarcies	Northern Plains	Bolilland	Northern Plateau	All	Southern Coast	Riverain Grassland	Southern Plains	All			Rogo	Zoza	Barbeji	All
	1	1.4	.8	3.3	2.4	1.3	3.0	2.4	1.8	2.5	2.0	1.7	2.7	7.1	7.5	5.1
	2	2.5	1.9	4.4	4.7	2.9	4.8	3.5	3.9	4.0	3.0	3.4	9.0	6.7	2.9	6.8
	3	4.5	3.6	4.9	5.8	4.5	6.3	4.9	5.1	5.2	4.3	4.7	6.2	5.4	4.2	6.7
1		8.4	6.3	12.6	12.9	8.7	14.1	10.8	10.8	11.7	9.3	15.9	17.9	19.2	14.6	18.6
	4	5.8	5.1	5.5	6.0	5.7	7.3	5.3	6.1	6.3	6.5	6.1	9.2	10.5	11.6	9.5
	5	7.8	6.9	6.3	6.4	7.5	7.6	5.9	7.3	7.6	7.8	7.7	8.6	13.0	9.5	7.1
	6	9.2	9.0	8.5	8.1	9.3	9.6	7.2	9.2	9.3	9.2	8.9	8.1	7.7	9.7	11.1
	7	10.5	11.5	9.7	13.6	10.5	11.2	10.0	11.4	11.1	11.3	10.9	14.3	8.7	12.6	11.7
2		33.3	32.5	30.0	34.1	33.0	35.7	28.0	34.0	34.3	34.8	33.6	40.2	39.9	43.4	39.4
	8	12.7	14.7	13.4	14.3	12.9	12.2	13.0	15.4	13.4	15.2	13.4	17.5	11.3	11.5	12.5
	9	16.1	18.7	18.0	17.1	17.8	15.7	17.0	16.9	17.2	17.6	18.1	8.8	13.5	11.9	11.4
	10	29.5	27.7	25.9	26.1	27.7	22.3	29.7	23.3	23.4	23.2	25.0	15.6	16.1	18.6	18.1
3		58.3	61.1	57.3	57.5	58.3	50.2	59.7	55.6	54.0	56.0	56.5	41.9	40.9	40.9	42.0
Gini Coefficient																
Income per Household		.45	.48	.38	.36	.42	.32	.45	.37	.37	.38	.41	.32	.26	.34	.31
Income per Capita		.42	.44	.36	.33	.41	.30	.41	.36	.35	.37	.39	.30	.23	.29	.28
Income per Consumer		.40	.44	.35	.29	.41	.29	.40	.34	.34	.36	.38	.30	.27	.29	.29
Coefficient of Variation (Income per Capita)		.89	.88	.80	.75	.83	.56	.69	.70	.69	.71	.83	.56	.41	.51	.51
Standard Deviation of the Log of Income (Income per Capita)		.97	1.22	.68	.76	.96	.58	.74	.77	.68	.90	.87	.56	.42	.42	.54

[a] Income classes have been defined according to income per consumer man-equivalent. Therefore, due to differences in family size and composition, the percentage shares of income may not increase consistently with income class.

Source: Survey Data

income per capita nationally. This compares with .27 found in Uganda (1970), .30 in Tanzania (1969), and .52 in Botswana (1974) as reported by the World Bank [Jain, 1975]. In contrast, incomes were least concentrated in the Nigerian villages as reflected in a Gini coefficient of only .28.

According to all measures presented, incomes within Sierra Leone were more concentrated in the poorer northern regions of the country. In the North as a whole, the Gini coefficient was .41, compared with .34 and .36 for the South and East respectively. Average incomes per capita and per consumer, presented in Table 3.5, also reflect the greater inequality in the North. For example, the ratio between the average income per capita of the richest and poorest decile in the North was 1:22 compared with 1:10 in the South and 1:12 in the East. Moreover, the greater inequality in the North is attributable to extremely low incomes among the poorest households. For example, while per capita incomes among tenth decile (highest income) households in the North were 94 percent of tenth decile incomes in the South and East, incomes of the poorest (first decile) households in the North were only 40 percent and 49 percent of first decile households in the South and East, respectively. The concentration of lower income inequality in the North is also reflected in the high log variance of income calculated for that region.

The relatively low degree of income concentration in the three Nigerian villages probably reflects the ecological homogeneity of the Nigeria study area, a result of the village selection procedure. While only minor differences are evident among the three villages, it is

Table 3.5 AVERAGE PER CAPITAL INCOME BY REGION AND INCOME STRATA FOR RURAL SIERRA LEONE AND NIGERIA[a]

Income Classes[b]		Sierra Leone (in Leone)											Nigeria (in Naira)			
		North					South				East	National				
Tercile	Decile	Scarcies	Northern Plains	Bolilands	Northern Plateau	All	Southern coast	Riverain grassland	Southern Plain	All			Rogo	Zoza	Barbeji	All
	1	8.56	6.94	27.96	12.12	9.23	30.89	27.07	20.82	25.87	19.48	14.26	17.52	26.43	20.92	19.19
	2	13.74	14.56	44.06	21.25	22.55	48.48	45.14	38.79	44.62	27.74	32.45	23.66	34.18	24.42	28.38
	3	25.41	29.48	40.44	30.06	33.57	61.81	46.77	47.98	52.22	47.29	42.67	29.86	45.76	38.45	35.46
1		16.11	17.91	36.89	18.14	29.50	47.06	39.66	35.60	40.91	32.16	29.95	21.31	34.55	27.23	27.68
	4	36.80	39.32	43.33	33.68	43.19	66.15	56.24	64.97	64.14	75.22	53.72	35.83	51.26	38.96	45.36
	5	49.75	58.41	66.79	38.86	51.26	79.92	75.93	79.37	76.93	81.29	71.73	46.52	54.04	57.18	54.53
	6	64.90	71.70	76.82	90.67	74.49	93.16	91.88	99.35	93.46	103.07	82.33	57.83	64.39	71.23	58.32
	7	73.84	102.78	104.02	71.51	82.99	114.31	112.79	109.02	120.62	121.87	100.89	63.36	62.21	63.11	66.63
2		56.76	68.27	70.21	58.70	62.98	88.38	84.21	87.43	88.87	93.34	77.17	49.73	57.26	57.65	56.21
	8	99.83	115.65	99.10	81.93	100.25	131.99	153.28	159.58	136.65	155.16	124.74	69.99	71.60	75.55	73.59
	9	115.28	172.84	201.32	82.01	152.56	154.16	193.47	188.45	184.65	177.73	179.73	85.34	99.92	93.17	89.12
	10	212.74	187.24	211.74	157.77	218.62	213.60	294.90	249.51	248.59	257.21	238.23	108.83	103.47	106.23	104.32
3		142.62	160.78	166.99	107.24	155.65	166.58	213.88	194.60	189.95	198.21	180.31	86.25	91.66	91.80	89.01

[a]All statistics have been calculated as simple averages using households as units of observation. Figures presented for the Nigeria study elsewhere [Matlon, 1977, 1978, 1979] were computed as weighted means

[b]Income classes have been defined according to income per consumer man-equivalent.

Source: Survey Data

important to note that inequality was highest in Rogo, the largest and most densely populated of the villages. The implications of these inter-village differences and possible causal factors are discussed later.

The Incidence of Absolute Poverty

A meaningful appreciation of any given distribution of income requires combining information of relative inequality among recipients with knowledge of the absolute levels of income attained by recipients in each stratum. In this section the distribution statistics are translated into terms which have somewhat greater meaning from a welfare perspective. To do this, we identify the proportion of the rural population in both case studies which could be classified as being in absolute poverty. For our purposes a poverty line was defined as that level of income at which a household would be able to obtain sufficient food to meet its minmum calorie requirements.[1]

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[1]The definition and measurement of absolute poverty, of course, pose substantial conceptual as well as empirical problems. Considerable work on these questions has been done through the Income Distribution and Employment Programme of the ILO. See, for example, Szal [1977], Sen [1974, 1978] and van Ginneken [1976]. Although a poverty line can generally be defined as that level of income below which a household's minimum needs are not being met, the problem lies in delimiting the scope and level of that minimum needs standard. In its most general sense, minimum needs can be defined to include a range of societal goods including education, health, and political participation. A more limited definition can be confined to the basic physical necessities of food, clothing, and shelter. A not uncommon approach is to concentrate on food alone, examining food intake relative to physiological needs. While undernutrition (caloric shortage) is only one reflection of poverty, it is perhaps the most pervasive as well as being causally related to other aspects of poverty such as morbidity, low labor productivity, and mortality. Moreover, because minimum calorie requirement estimates exist, undernutrition is also one of the few basic needs for which reasonably objective and culturally neutral standards can be established.

Poverty lines were estimated at three levels:

1. A minimum standard was defined as that level of income equal to the value of an amount of the basic food staple just sufficient to supply required caloreis. That is, if all income were spent on the staple commodity, this standard indicates at what level households would meet their caloric needs. In Sierra Leone rice was used as the food staple, and in Nigeria the staple was sorghum and millet in a 4:1 ratio (the observed production mix).[1]

2. An intermediate poverty line was defined as that level of income at which minimum caloric needs would be met if the household's entire food budget were allocated to the food staple. The food budget was estimated as that portion of total income allocated to food by households in the poorest decile. An analysis of the Nigerian data showed this proportion to be 87 percent. In Sierra Leone, the food budget share of earned income was taken to be 85 percent. This standard allows approximately 15 percent of income to be spent towards meeting minimum non-food needs.

3. The highest or most liberal poverty line was set at that income level which would just satisfy caloric needs if the food budget share of the poorest strata were allocated to the average diet in each area. In Nigeria it was observed that sorghum and millet represented 40 percent of the average food budget but supplied 64 percent of calories [Simmons, 1976b].

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[1] Food composition tables for Africa indicated the following caloric equivalencies for the staple grains: sorghum - 343 calories/100 grams; millet - 387 calories/100 grams; and rice - 364 calories/100 grams [FAO, 1968]. All figures represent edible portions.

In Sierra Leone, analysis showed that rice constituted 56 percent of the food budget.[1] In the absence of data indicating the proportion of total calories supplied to rural Sierra Leone households rice, a figure of 70 percent was assumed.[2] These ratios were applied to adjust the cost of calories for the overall diet in both study areas.

To estimate the cost of calories, weighted average grain prices for the three Nigerian villages and average prices for unmilled rice in each of the eight Sierra Leone resource regions were used. Adult male calorie requirements were assumed to be 2950, a figure in line with requirement levels estimated for northern Nigeria [Simmons, 1976b]. Caloric levels were related to incomes per consumer man-equivalent calculated for each households. Equitable intra-household food distribution was assumed and no allowance was made for special risk groups (e.g. pregnant and nursing women).

Table 3.6 presents the regional grain prices used in the analysis as well as the minimum income per consumer calculated to delimit the poverty line at each of the three levels. The percent of households as well as the percent of people in each region falling below the respective poverty standards are shown in Table 3.7.

The figures reflect a surprisingly high incidence of poverty, particularly within Sierra Leone. Nationally, 37 percent of the sample population

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[1] King and Byerlee [1977].

[2] A more detailed analysis of food consumption among the Sierra Leone households is now being conducted by Victor Smith of Michigan State University under contract AID/DSAN-C-0008.

Table 3.6 COST OF FOOD STAPLES AND MINIMUM INCOME PER CONSUMER USED TO DEFINE POVERTY LINE, BY REGION IN SIERRA LEONE AND NIGERIA

Region	Cost of Staple Grain Per Kilogram[a]	Poverty Line in Income Per Consumer		
		Level 1	Level 2	Level 3
SIERRA LEONE		(in Leone)		
North				
Scarcies	.163	75	88	111
Northern Plains	.173	80	94	118
Bolilands	.160	74	87	109
Northern Plateau	.189	87	103	129
South				
Southern Coast	.163	75	88	111
Riverain Grasslands	.092	42	50	62
Southern Plains	.161	74	88	109
East (Moa Basin)	.196	90	106	133
		(in Naira)		
NIGERIA	.096	34	39	54

[a]Represents the cost of unmilled rice in Sierra Leone and threshed millet and sorghum in Nigeria. Prices were taken from Spencer and Byerlee [1977], and Matlon [1977].

Source: Survey Data

Table 3.7 THE INCIDENCE OF ABSOLUTE POVERTY AMONG RURAL HOUSEHOLDS IN SIERRA LEONE AND NIGERIA

Region	Percentage of Households Below Poverty Line			Percentage of Persons Below Poverty Line		
	Level 1 Entire Income Spent on Staple Grain	Level 2 Entire Food Budget Spent on Staple Grain	Level 3 Food Budget Spent on Average Diet	Level 1 Entire Income Spent on Staple Grain	Level 2 Entire Food Budget Spent on Staple Grain	Level 3 Food Budget Spent on Average Diet
SIERRA LEONE	31	40	56	37	44	62
North	45	52	70	48	52	70
Scarcies	45	53	68	42	51	71
Northern Plains	46	49	66	51	54	69
Bolilands	39	44	64	45	50	66
Northern Plateau	52	69	87	61	74	94
South	21	28	41	24	31	48
Southern Coast	23	32	52	26	35	60
Riverain Grasslands	10	14	25	13	15	31
Southern Plains	30	30	46	32	40	48
East (Moa Basin)	35	45	59	33	43	63
NIGERIA	7	11	28	10	17	35
Rogo	13	15	38	20	31	48
Zoza	3	6	21	2	7	26
Barbeji	6	11	26	8	19	30

Source: Survey Data

resided in households within which earned incomes were below the level needed to obtain sufficient rice to meet calorie requirements. Liberalizing the standard to reflect minimum expenditures on non-food items, and then to take account of non-rice food needs, the percent of the population estimated to be in poverty increased to 44 percent and 62 percent, respectively. Households located in the North were at greatest risk with 48 percent of persons sampled in that region below the lowest poverty line (level 1). Within the North, the Northern Plateau and Northern Plains reflected the most severe welfare problems with more than half of the population within each region in level 1 poverty. The lowest incidence of impoverishment in Sierra Leone was recorded in the Riverain Grasslands, a result which largely reflects the low cost of rice. Similarly, the Nigerian data reflect a relatively low poverty incidence, though substantial welfare problems for the poorest third of the sample are nevertheless clear.

These figures are, of course, approximate and intended only to illustrate the rough magnitude of absolute poverty implied in the income statistics. Moreover, because they were derived from one year's earned incomes, they do not necessarily reflect actual caloric shortfalls.[1] However, the

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[1]This is true because of dissavings and gift flows which were not accounted for in the income data. For example comparing actual total expenditure figures estimated by King and Byerlee [1977] with generated incomes, a dissavings rate of approximately 130 percent was estimated for first decile households in Sierra Leone. Similarly, a dissavings rate of 23 percent was calculated for the poorest strata of Nigerian households. The flow of both cash and kind gifts was also examined in the Nigerian case. It was concluded that such flows do improve the welfare of the poorest households. But since the magnitude of such exchanges is relatively small, the improvement in income for the poorest households was only marginal. For example, net gift flows would have increased incomes of first decile households by only 2.4 percent [Matlon, 1978].

results are generally consistent with the few nutrition surveys conducted in Sierra Leone which have reported a chronic shortage of calories among the rural population.[1]

Caloric Intake Among Income Classes

Only the Nigerian data were in a form which permitted an examination of actual caloric intake by income strata.[2] Figure 3.1 shows that on average the sample households consumed nearly 11 percent more calories than the minimum required level. However, there was considerable unevenness across income strata. Among households in the first and second deciles domestic food crop production fell below requirements by approximately 70 percent and 50 percent, respectively. Indeed, on average domestic food production met consumption requirements only among households in the ninth and tenth deciles reflecting considerable dependence on the market for meeting subsistence needs.[3] Furthermore, after netting out sales and adding food purchases and gift transfers, the first and second deciles still experienced calorie deficits of approximately 25 percent and 15 percent. Finally, substantial caloric surpluses in the form of

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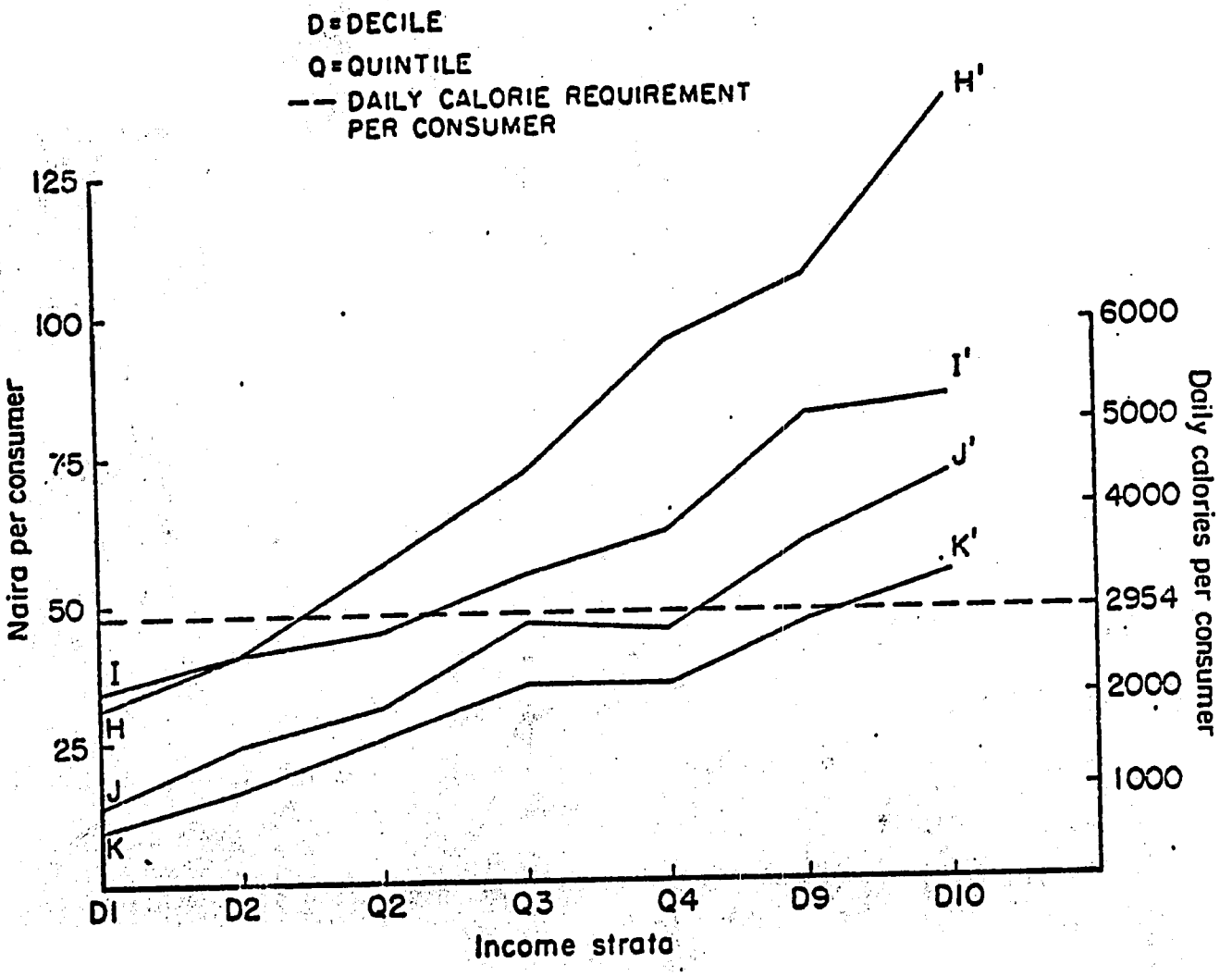
[1]For example, 30 percent of children aged zero to five were reported to be at least 20 percent underweight according to weight/age growth standards of the National Academy of Science [Government of Sierra Leone and UCLA, 1978]. A general lack of calories was also observed among the adult population in several surveys reviewed by Kolasa [1978].

[2]Caloric consumption was calculated using the residual method by subtracting annual sales, gifts given, and estimated storage losses from the total food crops harvested plus annual purchases and gifts of food received.

[3]Analysis showed that the proportion of consumed grains which were purchased declined rapidly with rising income status - from nearly 25 percent among first decile households to only 8 percent among households in the tenth decile.

FIGURE 3.1 AVAILABLE FOOD PER CONSUMER BY INCOME STRATA IN NAIRA AND APPROXIMATE DAILY CALORIE EQUIVALENTS



HH' = Total harvest value
I I' = Available food (KK' - food purchases)
J J' = Food crop harvest
KK' = Retained food (JJ' - sales, gifts, storage losses, and seed)

retained food stocks were calculated only in the ninth and tenth deciles. This indicates that the bulk of grains sold to calorie deficit families during the pre-harvest hunger period would be supplied by high income households.

In summary, although rural incomes were not highly concentrated in either Sierra Leone or Nigeria, because of the low average levels the income figures reveal a serious degree of absolute impoverishment among the poorest 20 to 40 percent of the rural population.

The Components of Rural Inequality

Decomposition of Rural Inequality By Locality

By dividing national income variation into within locality and between locality components, it was possible to determine what percent of national inequality in Sierra Leone was caused by income variation within villages and regions or between villages and regions. Several decomposition techniques have been developed and applied in other income studies. However because these techniques often yield inconsistent results, three approaches were used in the present study--decomposition of the Gini coefficient, of the variance of the logarithm of income, and of the Thiel index.[1] Table 3.8 summarizes the results of the decomposition analysis as applied to the Sierra Leone data.

The results indicate that the greatest proportion of inequality at the national level was accounted for by variation within enumeration areas.

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[1] For applications elsewhere see Mangahas [1975] (Gini coefficient); Fields and Schultz [1977] (variance of the log of income); and van Ginneken [1976] (Thiel index). The mathematical derivation of each technique is given in Appendix A.

Table 3.8 THE PERCENT OF RURAL INCOME INEQUALITY EXPLAINED BY WITHIN AND BETWEEN LOCATIONAL COMPONENTS IN SIERRA LEONE

Level of Analysis	Locality Components	Method of Decomposition[a]					
		Gini Coefficient		Log Variance		Thiel Index	
		Within	Between	Within	Between	Within	Between
National	Enumeration Area	81	19	72	28	69	31
	Eight Resource Regions	96	4	92	8	95	5
	Combined Resource Regions	98	2	94	6	97	3
North	Enumeration Area	75	25	65	35	60	40
	Resource Region	98	2	97	3	98	2
South	Enumeration Area	89	11	89	11	88	12
	Resource Region	99	1	100	0	99	1
East	Enumeration Area	90	10	91	9	86	14

[a]See Appendix A for a mathematical derivation of each method.

Source: Survey Data

Although each method gives somewhat different estimates the figures indicate that this component contributed between 70 and 80 percent of overall rural inequality. Conversely, differences in mean incomes between enumeration areas contributed only 20 to 30 percent of aggregate inequality. Similarly, locational differences among the eight resource regions added between only 4 to 8 percent to total rural inequality, and mean income differences among the three combined resource regions contributed only 2 to 6 percent.

In short, while the earlier data showed substantial inter-regional inequalities with a concentration of low incomes in the North, such locational differences explain only a minor proportion of overall rural inequality. The key determinants of inequality clearly occur at the village or enumeration area level. This suggest that policies directed at reducing national inequality through the allocation of investments to low income regions in an effort to equilibrate regional means will have a negligible impact unless the causes of intra-village disparities are effectively attacked as well.

Village Level Factors Affecting Inequality

It is recalled that in a comparison of inequality among the three Nigerian villages, the data suggested that village level inequality was directly associated with increased pressure on the land, with improved road access, and with an increasing proportion of income generated off-farm[1]--results which are consistent with the macro structural change model

[1]Non-farm enterprises provided 36 percent of income in Rogo where incomes were most concentrated, falling to about 25 percent in both Zoza and Barbeji.

set out in Chapter 1. An examination of income distribution at the enumeration area level in Sierra Leone revealed similar patterns. Among the 19 enumeration areas for which there were sufficient household observations to calculate measures of inequality, the data showed a direct association between inequality and population pressure. A particularly rapid increase in the Gini coefficient occurred at population densities exceeding 40 persons per square kilometer (approximately 100 persons per square mile). The mean Gini coefficient calculated for the seven enumeration areas with densities greater than 40 persons/km^2 was .37, compared with .30 for those 12 areas below that figure.[1] When the enumeration areas were disaggregated into four categories on the basis of transport accessibility, the data also showed that inequality was highest in those enumeration areas adjacent to major roads and lowest in remote locations.[2]

Because enumeration area accessibility and population density were intercorrelated, the separate association of each factor with village inequality was described by means of multiple regression analysis. Three dependent variables were employed--the Gini coefficient, the log variance of income, and the Thiel index. These measures are most sensitive to inequality in the middle, low, and high income ranges, respectively. To

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[1] A two tailed t-test showed this difference to be significant at the 2.5 percent level.

[2] The four categories were: 1 - excellent, located on a major all season road; 2 - good, located near a major road with fair all season access; 3 - poor, access difficult during the rains; 4 - remote, motor access impossible during the rains. The mean Gini coefficients and standard deviations calculated for these categories were:

1	2	3	4
.3523	.3160	.3237	.2725
(.0723)	(.0723)	(.0348)	(.0725)
n = 7	n = 4	n = 5	n = 3

capture increasing rates of inequality at higher densities, a semi-log functional form was employed. The estimated equations explaining enumeration area inequality were:

$$\ln Y_1 = \underset{(11.85)}{-1.24} + \underset{(1.25)}{0.129T} + \underset{(0.18)}{0.002X} \qquad R^2 = .11$$

$$\ln Y_2 = \underset{(1.59)}{-0.95} + \underset{(1.63)}{0.984T} - \underset{(0.70)}{0.004X} \qquad R^2 = .14$$

$$\ln Y_3 = \underset{(8.40)}{-1.92} + \underset{(1.54)}{0.357T} - \underset{(0.01)}{0.0001X} \qquad R^2 = .15$$

where Y_1 is the Gini coefficient, Y_2 is the log variance of income, Y_3 is the Thiel index, T is a dummy variable for accessibility, and X is population density. Degrees of freedom for all equations was 16. t-statistics are in parentheses.

The results show that although both variables explain only a small proportion of village inequality, regardless of the nature of that inequality, improved accessibility did reflect a significant association with greater concentration of income (at the 15 percent level). Although the mechanisms producing this result are not entirely clear, it is likely that with improved transport infrastructure resulting in greater integration into the market economy, non-farm and cash cropping opportunities have emerged which could be most effectively exploited by higher income households with surplus capital. This explanation relies upon a shift towards greater cash cropping emphasis or towards more capital intensive non-farm enterprises among higher income households. Both factors were examined and are discussed in subsequent chapters.

Decomposition of Rural Inequality By Income Source

In order to determine how the various sources of income contributed to overall inequality, further analysis examined the composition of incomes

by source across income strata. Table 3.9 presents the percent of income in seven enterprise sets disaggregated by region and income class. The data show that regional factors exert an important influence in determining the association between enterprise emphasis and income. For example, in the two relatively high income and ecologically favored regions of Sierra Leone, the South and East, the proportion of income derived from crop production increased directly with income. In contrast, in the more arid North where the cropping season was shorter and farming opportunities were generally more limited, the opposite pattern was evident reflecting a shift of higher income households into more profitable non-farm enterprises. In this respect, the Nigerian sample is again most similar to the North of Sierra Leone. Among the Nigerian sample households, farm incomes decreased from approximately 77 percent of total income in the lower three quintiles to 61 percent in the highest income strata.

Within Sierra Leone only hired labor earnings show a consistent pattern both nationally and regionally with wage incomes decreasing from 11 to 3 percent between the low and high income strata. Although the percent of income from hunting, gathering and fishing increased among higher income households nationally, this was due primarily to the strong positive association in the North. It should be noted that fishing in the North is dominated by capital intensive salt water operations compared with a greater presence of fresh water fishing requiring smaller inputs of capital in the South and East. No consistent patterns were apparent in Sierra Leone for small scale industry, livestock, or trading.

Similar to the Sierra Leone results, the relative contribution of hired labor in the Nigerian villages declined with income status. The

Table 3.9 THE PERCENTAGE OF INCOME DERIVED BY SOURCE AND INCOME STRATA IN SIERRA LEONE AND NIGERIA

Region	Income Class	Annual Crops	Tree Crops	Small Scale Industry	Hunting, Gathering, Fishing	Livestock	Trading	Hired Labor	Total
SIERRA LEONE									
North	Tercile 1	69.2	13.2	3.1	1.4	0.9	0.2	11.7	100
	Tercile 2	73.2	7.6	5.0	7.9	-	1.2	5.0	100
	Tercile 3	68.1	4.9	7.4	16.0	0.2	0.8	2.6	100
South	Tercile 1	51.2	28.3	1.7	8.0	0.1	0.8	9.9	100
	Tercile 2	54.3	27.0	4.6	6.1	-	0.2	7.7	100
	Tercile 3	60.7	23.2	5.7	6.1	-	0.8	3.6	100
East	Tercile 1	40.2	34.9	10.9	1.0	-	4.4	8.6	100
	Tercile 2	53.9	30.7	9.3	1.0	0.8	1.6	3.1	100
	Tercile 3	47.8	43.1	6.2	1.6	-	0.3	0.5	100
All	Tercile 1	58.0	22.3	5.1	2.4	0.4	1.5	10.5	100
	Tercile 2	63.1	18.1	4.2	8.0	0.2	0.9	5.5	100
	Tercile 3	61.3	18.7	7.2	9.4	0.1	0.5	2.8	100
NIGERIA	Quintile 1	75.7	0.9	6.0	0.2	0.9	3.5	12.8	100
	Quintile 2	75.5	1.9	4.2	1.9	1.0	3.0	12.5	100
	Quintile 3	76.7	1.3	4.4	0.5	0.7	4.9	11.5	100
	Quintile 4	70.8	1.4	5.3	0.2	0.5	14.0	7.8	100
	Quintile 5	60.4	0.8	9.9	1.0	1.9	17.6	8.4	100

Source: Survey Data

clearest relationship, however, was for income from trading which increased from less than 4 percent among the lowest strata to nearly 18 percent among the highest. An examination of the timing of cash flows in both crop marketing and non-crop trading activities showed that the substantial percentage of trading income among higher income Nigerian households resulted from the reinvestment of agricultural surpluses during the immediate post-harvest period [Matlon, 1978].

The net effect of non-farm earnings on overall inequality was measured by comparing inequality indexes calculated for farm incomes alone (earnings derived from cropping enterprises), with those calculated on aggregate incomes. It was found that farm incomes alone were consistently more concentrated than total incomes in both countries. Gini coefficients calculated on per capita farm incomes were .43 in Sierra Leone and .32 in Nigeria, compared with coefficients on total incomes of .38 and .28 respectively. It is important to note, however, that this reflected a resolution of the conflicting effects of hired labor earnings compared with income obtained in other off-farm enterprises. Off-farm wage labor provided an important supplementary source of income for the poorest households in both countries thereby reducing the degree of both absolute and relative poverty. Among higher income households, however, off-farm activites tended to widen disparities by providing opportunities for the reinvestment of agricultural surplus. This was most clearly evident in the more arid North of Sierra Leone and in Nigeria where the cropping season is shorter and where high return capital intensive farming opportunities are more limited.

Female Incomes in Nigeria

The only major source of income not obtained in the Nigeria survey was earnings generated by women in trading activities.[1] Although these data were not obtained directly, information on female participation in trading activities was collected. By combining these data with information on returns to female occupations obtained through secondary sources [Simmons, 1976a], a rough estimate of female incomes was calculated to assess the effect of excluding this income source [Matlon, 1978]. Given the most reasonable assumptions regarding the intensity with which women worked, it was estimated that females contributed an average of ₦ 78 to household incomes. If added to the predominantly male-generated incomes reported above, this would represent an increment of 23 percent.

Particularly interesting is the distribution of estimated female earnings among income strata shown in Table 3.10. Because females in lower income households tended to pursue a larger number of occupations over a greater part of the year, such earnings reflect an inverse relationship with household income status. The highest mean female income, ₦ 103 per household, was calculated among households in the poorest decile, and the lowest, ₦ 52, was calculated among the richest decile of households. In percentage terms the inverse relationship between male and female earnings is particularly strong with the proportion of female to male earnings falling from 58 percent in the first decile to only 8

[1] Due to the Moslem custom of secluding married women of childbearing age within the compound, male enumerators were denied access to women engaged in food processing and petty trading activities. Furthermore, household heads generally displayed a reluctance to discuss costs and returns of such female occupations.

Table 3.10 ESTIMATED FEMALE EARNINGS GENERATED IN TRADING AND COMMERCIAL FOOD PROCESSING, NIGERIA

	Decile		Quintile			Decile	
Variable	1	2	2	3	4	9	10
Average number of occupation-months per household[a]	37	29	31	27	30	21	19
Average annual female earnings per household[b] (in Naira)	103	80	87	76	84	59	52
Female incomes as a percent of predominantly male incomes	58	34	31	24	20	15	8

[a]Occupation-months represent the total number of occupations worked by all females in the household multiplied by the months each occupation was pursued. These figures were derived from survey data.

[b]Estimated by combining average monthly female earnings observed by Simmons [1976] with employment levels recorded in the present survey.

percent in the tenth decile. While these data are highly speculative, they do suggest that female occupations play an important supplemental function among the poorest households, with lower income families relatively and absolutely more dependent on female earnings than higher income households.

Because these estimates were not believed to be sufficiently accurate for subsequent analysis, female earnings have not been included as a component of household incomes in the present study. But it is important to note that if included, inequality in the Nigerian sample would be reduced from a Gini coefficient of .28 to only .24 calculated on per capita incomes. The effect of including estimated female earnings on the relative ordering of households was also examined to assess the stability of the decile and quintile stratification set out above. It was found that inclusion would have resulted in only a marginal restratification of households, with the effects concentrated in movements among the lower three deciles.

Comparison of Rural and Urban Incomes in Sierra Leone

The preceeding analysis, and indeed the bulk of this report, has focussed on the distribution of rural income in Sierra Leone and Nigeria. In this section we briefly compare rural and urban incomes in Sierra Leone in order to place the rural distribution into a broader national perspective. Data on urban incomes in Sierra Leone were collected as part of a study of rural-urban migration carried out in conjunction with the rural households survey. The survey methodology and the approaches used

to estimate incomes are presented in Eponou [1979].[1] Additional urban income data are presented in Appendix B of this report.

There are, of course, important empirical and conceptual problems in making income comparisons between rural and urban areas. The cost of living differs widely between the two sectors and the components of income also differ substantially, especially the proportion of household production consumed domestically. This raises questions of how adequately market prices reflect the value of domestic consumption. While transfer payments in the form of net gifts received were excluded from earnings in both rural and urban areas, it is known that such transfers are an important source of support for recent migrants engaging in urban job search activities. Moreover, while rural incomes were based on a full accounting of activities over a period of a year, urban income estimates were based on figures reported for a single month. For all of these reasons it is not possible to draw unambiguous welfare comparisons between rural and urban populations. Nevertheless, with these reservations in mind, some general observations can be made relating incomes in the two sectors.

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[1] Several methods were applied to compute urban income depending on the type of employment. For members of households working in the large scale private sector and in government, earnings were computed as wages plus fringe benefits such as housing and allowances. In the case of self-employed persons, income was computed from average monthly returns to family capital and labor; that is, income was computed as gross revenue minus total input expenditures. Unemployed persons received zero income. Household income was derived as the sum of the earnings of all active members. Data was obtained in a single interview reflecting earnings in an average month and were annualized through multiplication by 12.

Among the sampled urban households mean per capita incomes valued at market prices were more than double the rural average, Le 206 compared with Le 94 (Table 3.11). In general, mean incomes were lower among small urban centers as were rates of unemployment. Thus the largest town and capital city, Freetown, showed the highest mean income, educational level, and proportion of work force employed in government, but also the highest unemployment.

Several measures of income inequality are shown for each urban area in Table 3.12. The data show that the level of inequality was generally higher in urban than in rural areas with an overall Gini coefficient of .44. Moreover, with the exception of Kono, inequality increased with town size and thus with the average level of income. The disaggregation of incomes by strata in Table 3.12 also shows that the wider disparities in urban incomes reflect particular inequality in the high income range. Thus the mean per capita income of urban households in the poorest decile was approximately equal to that of the poorest strata in rural areas (Le 16 compared to Le 14) while the mean incomes of the richest decile of urban households was more than triple that of the highest income rural households (Le 745 compared to Le 238).

Further analysis of per capita incomes by sector found that incomes were highest among employees of large scale firms (Le 261) followed by self-employed workers (Le 223) and by government employees (Le 218). As expected, per capita incomes were lowest in households where the head was either an apprentice (Le 99) or unemployed (Le 127). The data also reflected substantial returns to education, particularly at the secondary level. Mean

Table 3.11 INCOMES AND SELECTED CHARACTERISTICS OF URBAN HOUSEHOLDS IN SIERRA LEONE

	Urban Area				
	Freetown	Kono	Bo, Kenema, Makeni	Rural Towns	All
Population	200,000	117,000	20,000-100,000	2,000-20,000	-
Income					
Per capita	237	221	157	181	207
Per consumer	288	270	188	217	251
Household Size	4.7	5.6	5.8	4.7	5.1
Dependency Ratio	32	36	36	32	34
% Household Heads Educated at					
Uneducated	79.3	78.4	76.7	81.3	79.0
Primary	11.3	15.7	8.2	14.1	11.8
Secondary	4.0	2.0	2.7	1.6	3.0
Superior	5.3	3.9	12.3	3.1	6.2
% Heads Employed in					
Government	64.7	12.0	58.9	59.2	54.3
Large Private	6.0	32.0	12.3	2.0	10.9
Small Private	2.7	4.0	4.1	10.2	4.3
Self-Employed	10.7	40.0	11.0	22.4	17.1
Unemployed	3.3	0.0	4.1	0.0	2.5
Apprentice	12.7	12.0	9.6	6.1	10.9
Sample Size	150	50	73	49	322

Source: Survey Data

Table 3.12 THE DISTRIBUTION OF URBAN INCOME IN SIERRA LEONE BY LOCATION

		Urban Area				
	Income Class	Freetown	Kono	Bo, Kenema, Makeni	Rural Towns	All Urban
Per Capita Incomes	Decile 1	5	18	15	23	16
	Tercile 1	50	52	55	56	54
	Tercile 2	139	132	142	137	139
	Tercile 3	465	401	504	436	453
	Decile 10	801	638	820	596	746
Per Consumer Incomes	Decile 1	7	23	18	29	18
	Tercile 1	67	74	72	75	71
	Tercile 2	181	183	183	181	181
	Tercile 3	549	469	539	480	524
	Decile 10	946	721	880	675	861
Percentage Share of Incomes	Decile 1	1	1	1	1	1
	Tercile 1	8	9	10	11	9
	Tercile 2	24	32	33	38	28
	Tercile 3	68	58	57	51	63
	Decile 10	44	29	32	24	37
Percentage Share of Population	Decile 1	13	12	1	11	11
	Tercile 1	41	37	40	34	39
	Tercile 2	43	40	41	40	41
	Tercile 3	16	23	19	25	20
	Decile 10	6	8	8	9	8
Gini Coefficient[a]		.53	.42	.49	.43	.44
Coefficient of Variation[a]		1.21	.91	1.29	.92	1.16
Standard Deviation of Log of Income[a]		.68	.54	.66	.56	.64

[a]Calculated on income per capita.

Source: Survey Data

incomes in households with uneducated heads were Le 184 per capita, compared with only Le 189 for a primary level of education, but Le 516 for secondary education. It is significant that returns to education were highest in the large scale private sector, not in Government, reflecting the ability of private firms to bid more effectively for educated workers. Moreover, among urban areas returns to education were highest in Freetown underlining the pull of that urban center to educated migrants from throughout Sierra Leone.

Labor Migration and the National Income Distribution

We conclude this chapter by reviewing results of a migration study which was carried out in Sierra Leone in connection with the survey of rural houseolds. Earlier reports have described the migration process in some detail [Byerlee et al., 1976]. In this section we briefly re-examine these data in an effort to derive implications of migration on income disparities within rural areas and on the distribution of income between rural and urban sectors.

Examining rural-rural migration first the data showed that flows tended to follow wage rate differentials far more closely than inter-regional differences in income per capita (Table 3.13). That is, migrants tended to migrate out of rural areas within which wages were low into rural areas with significantly higher wages, while no consistent pattern was evident regarding mean income differentials between origin and destination regions. In large part this arose because average incomes hid substantial distributional differences. For example, although the Northern Plains (the major out-migration area) and Scarcies (the major in-migration

Table 3.13 RURAL-RURAL MIGRATION-GROSS RATES BY ORIGIN AND DESTINATION REGION[a]

Origin Region	Rural Wage Rate Le/hr	Income per Capita (Le/yr)	Destination Region: Scarcies	North: Northern Plains	North: Boli-lands	North: Northern Plateau	South: Southern Coast	South: Riverain Grasslands	South: Southern Plains	East: Moa Basin	To all Destinations: Gross Rates	To all Destinations: Net Rates
North												
Scarcies	.13	79	2.5	.3			.2		.1		.6	-5.2
Northern Plains	.07	92	3.6	1.3	.5	.3	.1	-	.7	.4	5.6	4.0
Bolilands	.07	99	.3	1.8	1.5	.4	.4	-	3.9	-	3.2	1.8
Northern Plateau	.08	66	.1	-	.1	1.6	-	-	.3	.2	.7	.1
South												
Southern Coast	.08	109	.6	.3	.4	-	1.5	3.5	6.7	.3	11.8	7.8
Riverain Grasslands	.08	123	-	-	-	.2	1.6	1.5	5.2	1.6	8.6	- .5
Southern Plains	.11	114	-	-	.1	.3	-	.2	5.5	1.7	2.8	-2.2
East (Moa Basin)	.08	118	-	-	-	-	-	.2	.9	3.7	1.1	- .6

[a]Gross migration rate is the rate per thousand of origin population and excludes intra-regional migration.

Source: Survey data reported in Byerlee, Tommy, and Fatoo [1976].

area) had similar average incomes, they were characterized by the most unequal distributions in the country. Moreover, most out-migration from the Northern Plains was from one particularly low income high population density area, while most in-migration to the Scarcies was to work as hired labor in the relatively high income fishing areas on the coast.

The effect of rural-rural migration on aggregate rural inequality was not clear, however, it was unlikely that rural income disparities have been reduced. For example, the data showed that the age, sex, and educational characteristics of migrants between rural areas were generally similar to those of the rural population as a whole. That is, no compositional differences were observed which would tend to change the mean income or distribution of income within either destination or origin areas. Although migration between rural areas was highly responsive to wage differentials,[1] and as such may have tended to reduce inter-regional income variation among hired laborers, due to the relatively modest participation of rural households in labor markets the impact on more general income differences between regions was probably quite small. Finally, the limited potential of rural-rural migration as a means of reducing aggregate rural disparities through equilibrating regional means is underlined by recalling results of the decomposition analysis which showed that inter-regional disparities in Sierra Leone contributed less than eight percent to overall rural inequality.

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[1]The elasticity of rural-rural migration with respect to origin area wages was -2.7, and 2.5 with respect to mean destination area wages [Byerlee et al., 1976].

The data on rural-urban migration pointed to two distinct migrant streams--those migrants who were largely uneducated leaving for reasons of poverty, and those who had received some education and who were seeking urban jobs to reap the returns from this education. Rural-urban flows of uneducated migrants were found to follow wage rate differentials more closely reflecting a close linkage between rural and urban informal labor markets. Wage rates in the small-scale urban sector, for example, were not much higher than the highest wage rural region. Moreover, when the urban wage rate for young urban migrants without education was adjusted for the probability of unemployment, it was not significantly different from average rural wages.

The pattern for educated migrants to urban areas was less clear. In general, however, because of more limited opportunities for educated laborers in rural areas, wage rates in destination areas were considerably more important than origin wages in determining the direction of movement as compared with uneducated migrants.[1]

Finally, the impact of rural-urban migration on the national income distirbution was also best seen by separating the individual effects of these two migrant streams. Uneducated migrants tended to originate in households with incomes generally below those of non-migrants (Table 3.14). A few who were unemployed in urban areas did experience hardship but a

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[1]The rural-urban elasticities of migration with respect to origin area wages were -.40 and -.07 for uneducated and educated migrants, respectively. In contrast, elasticities with respect to destination wages were 2.35 and 4.75 for the respective groups.

Table 3.14 RURAL PER CAPITA INCOMES OF RURAL HOUSEHOLDS WITH NON-MIGRANTS COMPARED TO HOUSEHOLDS WITH RURAL-URBAN MIGRANTS (IN LEONE)[a]

Type of Migrant[b]	Male[c]	Female[c]
1. Non-migrants	72.8	72.7
2. Uneducated rural-urban migrants	63.1	71.6
3. Educated rural-urban migrants	83.7	85.0

[a]For rural-urban migrants incomes refer to the rural household from which migrants originate. Incomes exclude rural-urban remittances.

[b]Includes only adults aged 15 to 35 years old.

[c]Differences between all male groups and between non-migrant and educated female migrants are significant at the 5 percent level.

Source: Survey data reported in Byerlee, Tommy and Fatoo [1976].

substantial number migrated back to rural areas when they were unsuccessful in finding urban employment. In short, it was likely that this stream probably reduced rural disparities and disparities between rural and urban areas, while substantially increasing inequality within urban areas.

The second stream of migrants, those with education, had quite different characteristics. This group tended to originate in higher income rural households and regions, and to migrate more successfully to urban areas with very little return migration. In this sense, they reflected an important outflow of human capital from the rural sector. While there was generally a period occupied by job search, support from urban friends and relatives importantly reduced the hardship. Furthermore, the earnings of these migrants was over twice the earnings opportunities in rural areas. Although some of their earnings were remitted to rural areas, the magnitude of these flows--only about 5 percent on average of urban earnings[1]--was generally too small to importantly affect rural incomes. This type of migration, then, also tended to reduce disparities within the rural sector, while contributing to a widened gap between rural and urban areas.

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[1]Net flows of remittances to rural areas averaged approximately Le 1.20 per month for all employed migrants.

IV. SOCIO-DEMOGRAPHIC CORRELATES WITH INCOME

An accurate identification of the characteristics of poverty households is of direct value in the design and delivery of programs assisting low income households. Data collected in the U.S. as well as in other developed countries have shown that low income families can be distinguished by a fairly common set of structural characteristics.[1] However, very few surveys in developing countries have collected sufficiently detailed household information to construct demographic profiles of families differentiated by income.

This chapter examines the extent to which the size and composition of the household and age of the household head were correlated with rural incomes. The absence of formal education among household heads in rural Sierra Leone and in the Nigerian villages prevented an analysis of the effect of education on incomes. Similarly, due to regional covariation it was not possible to examine the separate affect of ethnicity. However, the effect of political status was examined in the Nigerian case.

Family Structure and the Life-Cycle

It was suggested in Chapter I that in a rural economy characterized by a high ratio of arable land to population and by handtool production technologies, the size and structure of the household may importantly affect the income level of household members. Within a land surplus

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[1] For example, attributes found to be associated with poverty status include (1) a high dependency ratio, (2) a greater number of households headed by the elderly, disabled, or females, (3) low educational achievement, and (4) membership in ethnic minority groups,

environment, farmed area and hence gross farm income per household are likely to be closely determined by the number of household workers. It follows that income per consumer may be importantly determined by the ratio of workers to consumers; that is, by the household dependency ratio.

Numerous writers have argued that these relationships are systematically interrelated with the demographic life-cycle of family formation, growth, and decline [Chayanov, 1966; Rodgers, 1978]. Chayanov, for example, has presented a framework for analyzing peasant farming systems within which variation in income per consumer is explained as a function of household size and composition, both of which are associated with a family's development. If it is true that most households pass through such stages, it follows that normative judgements regarding the personal distribution of income and the design of prescriptive measures to affect that distribution, must take into account the contribution of life-cycle factors to observed income disparities [Kuznets, 1976].

To determine the presence of a life-cycle earnings pattern one would ideally trace the characteristics and incomes of actual cohorts through time. Unfortunately, time series data were not available. As an alternative, Table 4.1 examines how family composition, land use, and income vary with household size, a proxy for family growth. The Nigerian data allowed a further breakdown of households into nuclear and extended units.

The data show that in both Sierra Leone and Nigeria per capita and per consumer incomes tended to decline as household size increased. The figures suggest further that the reduction in income was at least in part

Table 4.1 INCOMES AND SELECTED CHARACTERISTICS OF HOUSEHOLDS AS RELATED TO FAMILY SIZE IN SIERRA LEONE AND NIGERIA

Number of Household Members	Income			Cultivated Area (Ha)			Dependency Ratio[a]	Number of Observations
	Per Household	Per Capita	Per Consumer	Per Household	Per Capita	Per Worker		
				Sierra Leone				
		(in Leone)						
1 - 3	359	146	164	4.4	1.71	2.03	17.3	76
4 - 6	416	88	112	4.6	.97	1.65	29.5	117
7 - 9	541	70	99	6.3	.81	1.75	38.5	76
10 - 12	745	69	99	10.2	.95	2.00	38.5	28
13+	1042	70	108	8.9	.60	1.70	49.9	31
				Nigeria[b]				
		(in Naira)						
				(Nuclear Households)				
1 - 3	186	70	89	1.4	.56	1.28	2.0	16
4 - 6	267	56	84	2.1	.43	1.69	2.8	29
7 - 9	332	43	72	2.2	.29	1.36	2.9	7
10 - 12	216	19	32	1.8	.16	1.07	4.7	2
				(Extended Households)				
4 - 6	314	65	87	3.0	.62	1.27	1.7	17
7 - 9	509	62	95	3.3	.40	1.20	2.2	14
10 - 12	557	51	81	4.0	.35	1.47	2.5	8
13+	646	38	58	3.5	.21	.78	2.5	7

[a]Due to differences in sexual work rules in Sierra Leone and Nigeria, distinct dependency ratios have been calculated. In Sierra Leone the number of persons less than 16 and greater than 65 has been expressed as a percent of total family size. Since females generally do not participate in farm work in Nigeria, the ratio employed is the ratio of consumers to workers. Consumers is defined as the number of consumer man-equivalents in the household (see Table 3.1 earlier) and workers is the number of male adult equivalents in the household who participate in weeding, the primary labor bottleneck activity [Matlon, 1979].

[b]No nuclear households had more than 12 members, and no extended households had fewer than 4.

Source: Survey Data

the result of an increasing dependency ratio associated with household expansion. While cultivated land per capita declined among larger households, this was primarily due to the smaller ratio of available workers in larger households. This is evident in the fact that the ratio of land per worker remained nearly constant across household size categories in Sierra Leone, and showed only a slight declining trend among the largest Nigerian households. In short, the data suggest that systematic variation in family composition, and not in access to land, was the underlying factor contributing to the lower incomes of larger households. Moreover, this explanation was most applicable to the Sierra Leone situation, characterized by lower man/land ratios.

A more detailed analysis of the life-cycle earnings pattern was conducted on the Nigerian data by cross-tabulating household characteristics according to household size and age of the household head [Matlon, 1979]. The stages of family development were inferred by tracing patterns across these two dimensions. Although a clear life-cycle income pattern was observed, the strength and timing of the pattern was importantly affected by the household's organizational structure (i.e., nuclear or extended).

Among nuclear units, the highest incomes were realized by smaller families in relatively early stages of development. As nuclear units developed, per capita incomes declined, with the most repid fall occurring among large nuclear families with heads 50 years or older (Table 4.2). An important exception was among families with heads aged 24 years or less for whom incomes were also relatively low in spite of favorable household member composition. The latter group may have been characterized by lack

Table 4.2 MEAN INCOME PER CONSUMER BY AGE OF HOUSEHOLD HEAD FOR NUCLEAR AND EXTENDED FAMILIES IN NIGERIA (IN NAIRA)

Age of Household Head	Nuclear Households		Extended Households	
	Income Per Consumer	Number of Observations	Income Per Consumer	Number of Observations
Less than 24	59.50	4	34.00	1
25 - 29	106.75	8	231.00	1
30 - 39	84.88	18	72.42	12
40 - 49	81.84	13	88.81	21
50 - 59	76.33	9	89.58	12
60+	52.50	2	41.50	4

of operating capital, limited land inheritance and by management inexperience. The decline in incomes for extended families occurred later with respect to the age of the head, with the most rapid decline occurring in units headed by men aged 60 or greater. This group was also associated with a sharp reduction in family size pointing toward the disintegration of the extended unit.

Finally, a cross-tabulation analysis of the Nigerian data revealed that three sets of households were significantly over-represented among the poorest 30 percent of households: (1) families headed by persons aged 60 years or greater; (2) families headed by persons less than 25 years old; and, (3) nuclear households consisting of seven or more residents (the mean household size). As a group these households constituted only 18 percent of the sample, but included 47 percent of all households included in the poorest three deciles.[1] In each case, households within these poverty subsets were characterized by either extremely unfavorable dependency ratios or by low land inheritance.

In summary, both the Nigeria and Sierra Leone data revealed that systematic changes in demographic composition which are integrally related to household growth and development contribute to a life-cycle income pattern. Moreover, it was clear in the Nigerian case that household structure importantly affects both the sequence and rate in which families experience these general income stages. Households which maintained or adopted an extended structure as they developed enjoyed consistently higher incomes than advanced nuclear units.

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[1]This was found to be significant at greater than .001 using the chi square test.

Although the number of exceptions to these patterns show that life-cycle factors accounted for only part of overall inequality, these results have three important implications. First, they indicate that a proportion of poverty among traditional small farmers may be associated with factors internal to the family. Only income transfers or production interventions which reduce labor requirements would be effective in alleviating this type of poverty. Second, since households currently in poverty due to demographic factors represent stages through which most families pass in the course of normal development, if a longer term income concept were applied the degree of income equality would be even higher than that observed. And third, with evidence of the declining popularity of extended family units in West Africa [Buntjer, 1970; Goddard, 1973], these results imply a tendency towards greater risk of impoverishment among the elderly.

The Effect of Political Status

It is recalled that the Nigerian data presented to this point were obtained from a randomly selected sample of households. An additional sample of six village political figures was purposively selected and included in the data collection procedure.[1] Table 4.3 shows that, as a group, these included some of the largest and richest households in the study villages. Composed of large paternal extended households, they

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[1]The village elites (masu-sarauta) for which data were obtained included the village heads in both Barbeji and Zoza, the most influential hamlet head in Zoza, and the head-farmer (sarkin-noma) in each village. See Hill [1972, pp. 295 and 316] for a discussion of these positions.

Table 4.3 INCOMES, DEMOGRAPHIC MAKEUP, AND PROGRAM PARTICIPATION OF VILLAGE ELITES IN NIGERIA

	Village Elites	Tenth Decile	Entire Random Sample
Household Size			
Family Size (average number of persons)	19.5	6.3	6.7
Number of Wives	2.5	1.2	1.4
Average Size of Farm (Ha)			
per household	11.4	3.2	2.5
per capita	.58	.51	.37
Incomes			
Income (₦)			
per household	2715	626	346
per capita	139	99	52
Participation in Government Programs			
Number of contacts with Extension Agent in last 5 years	5	0.3	0.3
Has bought fertilizer directly from Gov't stores (% of Heads)	50%	10%	1%
Kilograms of groundnut seed rec'd in State Gov't Relief Program	277	24	6
Kilograms of improved groundnut seed rec'd in seed multiplication program (Zoza only)	122	5	7
Kilograms on fertilizer received on credit (Zoza only)	145	13	17
Percent of household Heads who attended Adult Literacy Classes	50%	10%	8%
Percent of school aged children in school	27%	11%	6%

Source: Survey Data

provide examples of what has traditionally been considered the ideal Hausa unit. With three times the number of residents per unit, each of the six elite heads had two or more wives, compared with only 36 percent of the random sample with greater than one. Moreover, they represented a select group of particularly strong extended units in which still active fathers were supported by a work force of several adult sons. It is important to recognize, however, that they were clearly an atypical subset of the most affluent.

The factors which account for the high incomes of the elites were not fully explored. A full appreciation would require an analysis of family histories and a thorough understanding of the village political-economy as it operates through the patron-client system. Unfortunately, such data were not obtained. But because these elites constituted the primary interface with the government at the village level, they provided a useful case study of the possible implications of directing extension efforts through local officials.

The data in Table 4.3 indicate that the elites enjoyed substantially higher participation rates in all programs compared with both the overall random sample and compared to households in the tenth decile.[1] The differentials with respect to government inputs received were particularly

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[1]Among the three study villages, two primary schools were operating in Rogo, one in Zoza, but none in more remote Barbeji. Adult literacy classes had also been offered in both Rogo and Zoza. A single extension agent, located in Rogo, was responsible for the three village area. Two major input programs administered by the agent included groundnut relief seed distribution in 1973 (in response to the drought of the previous year), and seed and fertilizer distribution as part of the Kano State seed multiplication program. Both programs involved farmer credit.

significant. In interpreting the latter figures, it is important to keep in mind that extension agents were encouraged to work through the village political system in an effort to obtain maximum cooperation from farmers. Indeed, in both input distribution schemes observed, village and hamlet heads were given considerable responsibility in the selection of recipients and in subsequent disbursal. The abuses which resulted from this approach, however, were quite apparent. Of the total groundnut relief seed distributed in the three villages, it was estimated that 19 percent was diverted for the personal use of the selected elites. And in the Zoza groundnut seed and fertilizer distribution, it was estimated that 16 percent of both inputs were retained by the village head and head farmer.

A systematic effort was not made to determine the reaction of the general sample to the well known shares taken by the village officials. However, it was evident that many villagers, including the elites themselves, viewed such shares as appropriate to their positions as well as being partial payment for helping to administer the distribution. Since under some circumstances the village heads took on the responsibility of covering the credit default of poorer farmers, their shares were also viewed by some as payment for providing risk insurance. In any case, it would be unrealistic to expect any effective pressure from below to reduce such linkages.

Although King [1976] provides documentation of similar behavior at the village level in other northern states, the extent to which the observed case was typical of a more general phenomenon in Nigeria is not known with certainty. However, it is clear that with the development of

more improved technological packages, the current mode of extension activities may well result in even greater diversion of inputs away from intended recipients.

V. PATTERNS OF FACTOR USE AMONG RURAL INCOME STRATA

Preceding chapters have described the size distribution of income among rural households, discussed the implications of observed income levels on the incidence of absolute poverty, and analyzed how several socio-demographic variables contributed to variation in income per consumer. We turn now to an analysis of production relationships which underlie the household income distribution. In the present chapter we examine how factor use levels for land, labor, and capital varied among income classes. Subsequent chapters analyze the selection of enterprise combinations and factors influencing factor productivity among rural households.

Land Use

Many rural income studies conducted in developing countries have found that access to land is the single most important determinant of income. Indeed, lacking good income data, size of land holdings has commonly been used as a proxy variable to stratify households into income or welfare classes. But although the land proxy may have considerable practical appeal in a land-short environment or where land tenure institutions result in restricted access to land, its appropriateness within West Africa, which is characterized by low man/land ratios and generally egalitarian land tenure institutions, is questionable. Indirect evidence of an association between the amount of cultivated land and income was seen earlier in the discussion of life-cycle patterns. This relationship will now be examined directly.

Land use patterns across income strata are shown in Tables 5.1 and 5.2.[1] It is clear that in both countries household welfare, as reflected in income per consumer, was not closely related to area farmed per household. Simple correlation coefficients calculated between land and income per consumer were only .18 and .20 in Sierra Leone and Nigeria, respectively. As expected there was a somewhat stronger association between land per capita (or per consumer) and income per consumer, though again the correlation is not high. An examination of regional coefficients suggests that the strength of the correlation increases with rising population pressure. Thus in the most densely populated East (39 persons/km^2), the coefficient was .37, declining to .34 and .25 in the less densely populated North (23 persons/km^2) and South (26 persons/km^2). This general pattern is extended with reference to the Nigerian data where population pressure was greatest (50 persons/km^2) and the income-land correlation coefficient was also highest (.54).

The sizes of these coefficients as well as the relatively narrow ranges within which land holding varied across income strata indicate rather clearly that land use alone accounts for a relatively small proportion of income variation.[2] Moreover, the weakness of using a land

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[1] These figures refer only to areas actually cultivated. Most farmers in Sierra Leone controlled considerably larger acreages and practiced a brush fallow system for upland crops. Since the average age of brush is about ten years, this indicates that in practice farmers controlled on average roughly seven to nine times more land than is actually cropped in any one year.

[2] For example, the ratios between the mean land per capita levels of the richest and poorest deciles in Sierra Leone and Nigeria were both less than 2:1. In contrast, the corresponding income per capita ratios in the two samples were 17:1 and 6:1.

Table 5.1 PERCENTAGE DISTRIBUTION OF HOUSEHOLDS AMONG LAND AND INCOME STRATA IN SIERRA LEONE

Cultivated Land Per Household (Ha)	NORTH				SOUTH				EAST				NATIONAL			
	Terciles				Terciles				Terciles				Terciles			
	1	2	3	All	1	2	3	All	1	2	3	All	1	2	3	All
0 - 0.39	4	15	17	11	0	7	6	5	15	17	0	10	4	11	8	8
0.4 - 1.61	35	22	21	27	42	27	26	30	39	22	17	25	38	24	22	28
1.62 - 2.82	35	9	10	20	26	32	31	31	31	44	28	35	32	24	25	27
2.83 - 4.03	11	20	10	15	13	15	12	14	0	11	11	8	10	16	11	13
4.04 - 5.25	7	9	3	7	16	9	6	9	0	0	6	2	9	8	5	7
5.26 - 6.06	4	7	10	7	0	5	8	5	0	0	6	2	2	5	8	5
6.07+	4	18	28	15	3	5	12	7	0	6	33	18	5	11	20	12
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Mean Farm Size (Ha)	2.07	2.65	3.53	2.72	2.43	2.43	2.92	2.57	1.26	1.78	2.59	1.83	2.07	2.46	3.15	2.53
Cultivated Land Per Capita (Ha)																
0 - 0.19	32	31	28	30	26	22	10	18	39	28	0	20	31	27	13	24
0.2 - 0.39	44	26	7	29	39	25	14	24	15	28	22	22	39	26	13	26
0.4 - 0.59	15	15	14	15	19	24	18	21	8	28	11	16	15	21	15	17
0.6 - 0.79	4	9	17	9	3	14	26	16	8	6	17	10	4	11	21	11
0.8 - 0.99	2	6	10	5	7	5	8	6	15	0	11	8	5	5	9	6
1.00 - 1.19	0	2	7	2	0	9	6	6	0	0	6	2	0	5	6	4
1.20+	4	13	17	10	7	2	20	9	15	11	33	20	6	8	21	14
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Mean Land/Capita (Ha)	.29	.30	.46	.38	.47	.51	.68	.55	.30	.33	.47	.44	.35	.37	.59	.43
Simple Correlation Coefficients with Income per Consumer — Land		.2254				.1410				.3483				.1808		
Land/Capita		.3420				.2533				.3676				.3150		
Gini Coefficient on Land per Capita		.4554				.4146				.2961				.4269		

Source: Survey Data

Table 5.2 THE PERCENTAGE DISTRIBUTION OF HOUSEHOLDS AMONG LAND AND INCOME STRATA IN NIGERIA

Cultivated Land Per Household	Decile		Quintile			Decile		All
	1	2	2	3	4	9	10	
≤ .99	10	10	5	-	5	-	20	6
1 - 1.99	40	40	50	35	35	50	10	38
2 - 2.99	30	20	30	25	20	20	20	24
3 - 3.99	10	10	5	30	5	10	20	13
4 - 4.99	10	20	5	10	15	-	10	10
5+	-	-	5	-	20	20	20	9
TOTAL	100	100	100	100	100	100	100	100
Mean Farm Size (Ha)	2.2	2.4	2.2	2.4	2.9	2.7	3.2	2.5
Cultivated Land Per Consumer								
≤ .29	40	20	30	-	-	-	10	13
.3 - .49	40	60	30	25	30	30	10	31
.5 - .69	10	-	30	35	20	30	10	22
.7 - .89	-	-	10	30	30	-	30	17
.9+	10	20	-	10	20	40	40	17
TOTAL	100	100	100	100	100	100	100	100
Mean Land/Consumer (Ha)	.46	.45	.46	.65	.71	.89	.84	.63
Simple Correlation Coefficients with Income Per Consumer	Land			.2045				
	Land/Consumer			.5428				
Gini Coefficient on Land Per Capita				.3205				

[a]Calculated as the simple average of household observations. Figures reported in Matlon [1977, 1979] were calculated as weighted averages.

Source: Survey Data

proxy alone as a means of identifying poverty households can be seen by examining the distribution of households among the smallest land classes. Among the national sample in Sierra Leone, approximately 26 percent of the households included in the third tercile farmed land holdings amounting to less than .4 hectare per capita, and nearly 13 percent of these richest households farmed less than .2 hectare per capita. The most striking results were evident in the North where 28 percent of the third tercile farmers were in the lowest land strata, a proportion almost precisely equal to the regional distribution.

An important factor underlying these results was income earned in non-farm enterprises and its generally inverse relationship with land. Data summarized in Table 5.3 and 5.4, for example, show that among the third tercile households who farmed less than .2 hectare per capita, nearly 60 percent of income was earned in non-farm occupations. Similar earnings patterns are reflected in the Nigerian data. These tables also show that the relationship between the percentage of non-farm income and land status was not linear, but distinctively U shaped in all areas. That is, the proportion of income earned off-farm was highest among the most land short and among the most land abundant households. It is likely that the former set includes households who specialized to a greater extent in off-farm enterprises whereas the latter group includes households who were in a position to reinvest revenue gained from surplus agricultural production in non-farm enterprises.

Land Tenure

Most land is communally owned in both Sierra Leone and Nigeria with usufructuary rights held by individual households. The majority of

Table 5.3 PERCENTAGE OF INCOME EARNED FROM OFF-FARM SOURCES BY LAND AND INCOME STRATA IN SIERRA LEONE

Cultivated Land Per Household (Ha)	NORTH Terciles 1	2	3	All	SOUTH Terciles 1	2	3	All	EAST Terciles 1	2	3	All	NATIONAL Terciles 1	2	3	All
0 - 0.39	-52	46	68	31	-	27	43	31	191	14	-	120	42	40	65	48
0.4 - 1.61	23	25	29	25	24	21	27	24	16	23	3	17	25	19	28	23
1.62 - 2.82	4	18	4	10	24	21	16	21	-	7	2	6	13	16	17	15
2.83 - 4.03	8	10	7	8	17	25	16	19	9	3	14	9	12	14	13	13
4.04 - 5.25	- 8	11	23	11	19	8	5	12	-	-	5	5	8	17	4	11
5.26 - 6.06	4	11	11	10	19	20	2	16	-	-	15	15	5	17	11	13
6.07+	19	12	15	14	37	19	7	17	8	28	11	16	15	15	15	15
TOTAL	18	19	27	23	20	18	16	18	25	15	9	23	20	19	20	20
Cultivated Land Per Capita (Ha)																
0 - 0.19	- 4	33	59	30	26	19	41	26	107	16	-	71	23	29	58	34
0.2 - 0.39	16	15	27	17	18	20	20	19	5	18	2	11	17	17	19	17
0.4 - 0.59	- 2	6	8	4	22	30	15	23	19	6	16	12	11	17	15	15
0.6 - 0.79	-19	18	5	5	17	19	23	21	3	4	2	3	- 4	15	16	14
0.8 - 0.99	-59	8	7	- 2	19	14	8	14	2	-	10	6	6	10	11	7
1.00 - 1.19	-	9	7	7	19	15	12	15	-	-	2	2	-	15	9	12
1.20+	19	14	19	17	41	18	10	18	8	21	11	15	21	16	-	17
TOTAL	18	19	27	23	20	18	16	18	25	15	9	23	20	19	20	20
Simple Correlation Coefficient with Percent Non-farm Income	Land		-.1544				-.1989				-.3409				-.1720	
	Land/ Capita		-.2204				-.0978				-.3307				-.1602	

Source: Survey Data

Table 5.4 THE PERCENTAGE OF INCOME EARNED IN NON-FARM ENTERPRISES BY LAND AND INCOME STRATA IN NIGERIA[a]

Cultivated Land Per Household (Ha)	Decile		Quintile			Decile		All
	1	2	2	3	4	9	10	
0 - .99	42.5	55.6	20.0	-	63.8	-	79.7	56.7
1 - 1.99	38.0	21.4	25.3	27.9	33.4	45.5	22.5	30.8
2 - 2.99	6.6	32.5	21.0	22.7	28.4	56.3	38.9	26.1
3 - 3.99	6.7	22.2	5.2	16.0	2.2	27.9	19.8	15.4
4 - 4.99	27.7	11.6	4.4	3.8	35.8	-	13.2	18.4
5+	-	-	16.4	-	36.2	10.8	32.7	27.6
TOTAL[a]	24.5	25.3	21.3	22.6	27.9	36.4	37.0	26.7
Cultivated Land Per Consumer (Ha)								
0 - .29	28.4	37.0	32.5	-	-	-	87.4	36.2
.3 - .49	25.2	28.3	16.8	36.0	51.0	75.5	71.9	37.3
.5 - .69	27.7	-	12.9	16.5	27.8	26.1	19.5	19.5
.7 - .89	-	-	25.7	21.7	22.4	-	33.4	24.5
.9+	6.7	3.9	-	3.7	28.7	21.1	24.6	18.8
TOTAL[a]	24.5	25.3	21.3	22.6	27.9	36.4	37.0	26.7

[a]Calculated as the simple average of household observations. Figures reported in Matlon [1977, 1979] were calculated as weighted averages for each stratum.

Source: Survey Data

Table 5.3 PERCENTAGE OF INCOME EARNED FROM OFF-FARM SOURCES BY LAND AND INCOME STRATA IN SIERRA LEONE

Cultivated Land Per Household (Ha)	NORTH Terciles 1	2	3	All	SOUTH Terciles 1	2	3	All	EAST Terciles 1	2	3	All	NATIONAL Terciles 1	2	3	All
0 - 0.39	-52	46	68	31	-	27	43	31	191	14	-	120	42	40	65	48
0.4 - 1.61	23	25	29	25	24	21	27	24	16	23	3	17	25	19	28	23
1.62 - 2.82	4	18	4	10	24	21	16	21	-	7	2	6	13	16	17	15
2.83 - 4.03	8	10	7	8	17	25	16	19	9	3	14	9	12	14	13	13
4.04 - 5.25	- 8	11	23	11	19	8	5	12	-	-	5	5	8	17	4	11
5.26 - 6.06	4	11	11	10	19	20	2	16	-	-	15	15	5	17	11	13
6.07+	19	12	15	14	37	19	7	17	8	28	11	16	15	15	15	15
TOTAL	18	19	27	23	20	18	16	18	25	15	9	23	20	19	20	20
Cultivated Land Per Capita (Ha)																
0 - 0.19	- 4	33	59	30	26	19	41	26	107	16	-	71	23	29	58	34
0.2 - 0.39	16	15	27	17	18	20	20	19	5	18	2	11	17	17	19	17
0.4 - 0.59	- 2	6	8	4	22	30	15	23	19	6	16	12	11	17	15	15
0.6 - 0.79	-19	18	5	5	17	19	23	21	3	4	2	3	- 4	15	16	14
0.8 - 0.99	-59	8	7	- 2	19	14	8	14	2	-	10	6	6	10	11	7
1.00 - 1.19	-	9	7	7	19	15	12	15	-	-	2	2	-	15	9	12
1.20+	19	14	19	17	41	18	10	18	8	21	11	15	21	16	-	17
TOTAL	18	19	27	23	20	18	16	18	25	15	9	23	20	19	20	20
Simple Correlation Coefficient with Percent Non-farm Income	Land		-.1544				-.1989				-.3409				-.1720	
	Land/ Capita		-.2204				-.0978				-.3307				-.1602	

Source: Survey Data

holdings in Sierra Leone are obtained through inheritance or through other family settlements. Fees paid for use of land (on rental, pledging, or begging arrangements) were nominal averaging Le 1.50 per hectare for upland fields and Le 1.90 for swamp land. Although there were significant inter-regional differences in cost of land--with land costs highest in the Southern Coast and Northern Plains, and lowest in the Moa Basin--there was no apparent association with population pressure [Spencer and Byerlee, 1977]. The average payment made for land was approximately Le 5.00 per household with no correlation with income status. In short, land tenure institutions reflected only the beginnings of a land market and no mechanisms were apparent which may have operated to the disadvantage of smaller or lower income farmers.

Five tenurial arrangements were observed in Nigeria reflecting a somewhat more monetized land market than in Sierra Leone. Fifty-eight percent of farmed areas consisted of inherited fields, purchased fields constituted 20 percent, rented fields constituted 16 percent, pledged[1] fields represented 4 percent of farmed area, and 3 percent of total land had been cleared out of the brush by the current operator. It is notable that only the percentage of land held as pledged fields showed a consistent and positive association with income status, reflecting the concentration

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[1]Pledged (jingina) fields are those for which use rights have been temporarily transferred as collateral on a loan. Use rights remain with the loaner until repayment is completed. While only a small proportion of all cash loans involved the pledging of land, pledging is not uncommon in those cases where the magnitude of the loan is high and the borrower is considered to be a default risk. Many such transfers become equivalent to purchases over time.

of creditor households among the upper income strata. But even this was relatively minor varying between zero in the lowest decile to only 10 percent among households in the richest decile.

The cost of land in Nigeria was substantially higher than in Sierra Leone, in part due to the higher land pressure. Nevertheless, land charges well below the value of land in production. The average rental fee for upland fields was approximately ₦ 5.00 per hectare for upland fields and ₦ 20.00 for lowland fields. Since only a small proportion of fields had been obtained through payment, the average cost of land per houseold was only ₦ 2.00. Again no systematic biases against lower income farmers were apparent. Finally, an analysis of land holdings by type (upland or lowland) in Nigeria showed that in only one village (Barbeji) did higher income households control a significantly greater proportion of the high value lowland soils than did middle and low income households.

In short, the available evidence does not suggest that land use explained a substantial proportion of either income variation or the incidence of low incomes. While the correlation between land use and income was highest in areas characterized by greater population pressure, even in those areas the continued availability of land through traditional communal land tenure systems combined with access to non-farm employment reduced the income effect of the land constraint. However, a comparison of the Sierra Leone and Nigerian results, as well as patterns within Sierra Leone suggests that with increasing population pressure and further commercialization of the land market, access to land will become an

increasingly important determinant of income and a possible source of increased inequality..

Labor Use

Employment in both Sierra Leone and Nigeria followed distinctly seasonal patterns reflecting the annual distribution of rainfall and the dominance of farm labor. Labor peaks occurred during June and July, and a slack agricultural period extended from January through March in Sierra Leone and from December through April in Nigeria. Annual employment levels for all activities, farm and non-farm, were substantially higher in Sierra Leone (approximately 1,500 hours per adult male) than in Nigeria (roughly 700 hours per adult male). This difference was due to two factors. First, the cropping season extends for roughly 170 days in Sierra Leone compared to only 120 days in Nigeria. Second, the bush fallow rice cultivation system practiced in Sierra Leone requires considerably more labor per unit of land than does the continuous cultivation of sorghum, millet, and groundnut practiced in Nigeria. The average labor per hectare required for upland rice in Sierra Leone, for example, was 1840 hours compared with only 675 hours per hectare for the most common upland crops in northern Nigeria. A final critical difference between the two study areas regards the role of women. In Sierra Leone women provided approximately 40 percent of farm labor compared with an insignificant proportion among the predominately Moslem households in the Nigerian sample. Females in both areas were active in non-farm activities, although for reasons discussed earlier, such data were not obtained in Nigeria.

Employment profiles for each country are summarized in Tables 5.5 and 5.6. Within Sierra Leone hours of recorded labor were highest among

Table 5.5 AVERAGE HOURS WORKED PER MONTH BY ADULT MALES AND FEMALES BY ACTIVITY, REGION, AND INCOME CLASS IN SIERRA LEONE[a]

			NORTH				SOUTH				EAST			
			Tercile				Tercile				Tercile			
Sex	Period	Sector	1	2	3	All	1	2	3	All	1	2	3	All
Male	All Year	Farm	95	114	110	105	83	83	91	84	76	80	73	77
		Hired Labor	15	15	11	14	10	13	14	12	6	5	1	5
		Non-Agricultural	8	14	25	14	16	22	26	21	11	15	9	12
		Total Hours	118	142	145	133	109	118	131	118	93	100	84	94
	Peak	Farm	130	158	147	144	99	103	112	104	98	99	91	97
	(June-	Hired Labor	21	13	11	15	9	10	10	10	6	6	a	4
	August)	Non-Agricultural	3	10	19	9	13	25	23	21	12	7	8	9
		Total Hours	153	181	177	168	122	137	146	134	116	112	99	110
	Slack	Farm	52	68	68	61	68	58	72	65	68	67	65	67
	(January-	Hired Labor	12	19	19	16	13	17	16	15	11	8	2	8
	March)	Non-Agricultural	15	20	30	19	14	17	24	17	11	18	15	15
		Total Hours	78	106	117	96	95	92	112	97	90	93	82	89
Female	All Year	Farm	65	70	70	68	46	59	54	54	45	59	67	56
		Hired Labor	1	2	2	2	5	4	3	4	4	4	a	3
		Non-Agricultural	14	14	17	14	15	21	20	19	13	11	13	12
		Total Hours	80	86	89	84	66	85	78	77	62	74	81	72
	Peak	Farm	105	110	115	109	74	87	86	83	80	104	99	94
	(June	Hired Labor	2	3	a	2	4	3	2	3	3	2	-	2
	August)	Non-Agricultural	6	8	12	8	11	14	17	12	12	7	8	9
		Total Hours	112	120	127	119	89	104	106	98	94	114	107	105
	Slack	Farm	18	31	30	25	14	21	24	20	19	22	42	26
	(January-	Hired Labor	1	2	5	2	1	3	a	2	5	4	a	4
	March)	Non-Agricultural	23	18	22	20	19	28	30	25	14	20	22	19
		Total Hours	42	51	58	47	35	52	54	48	38	47	64	48

[a]Less than one.

Source: Survey Data

Table 5.6 AVERAGE HOURS WORKED PER MONTH BY ADULT MALES BY ACTIVITY AND INCOME CLASS IN NIGERIA[a,b]

Period	Sector	Income Class			
		Low	Middle	High	All
All Year	Farm	35.6	53.8	45.0	45.3
	Hired Farm Labor	5.5	1.8	0.6	2.5
	Non-Agricultural	13.1	7.3	7.6	9.1
	Total Hours	54.2	62.9	53.2	56.9
Peak	Farm	70.2	107.3	85.3	88.6
(May-July)	Hired Farm Labor	9.5	1.2	1.5	3.7
	Non-Agricultural	10.1	1.5	2.8	4.5
	Total Hours	89.8	110.0	89.6	96.8
Slack	Farm	10.9	16.7	12.7	13.6
(January-	Hired Farm Labor	3.3	2.7	-	1.9
April)	Non-Agricultural	13.3	8.5	7.6	9.6
	Total Hours	27.5	27.9	20.3	25.1
Number of persons observed		20	24	24	

[a]Travel time to and from places of employment as well as work within the family compound are not included in these figures.

[b]Since labor data were obtained only from the intensively interviewed sample of 35 households in Nigeria, only those households have been included in this table.

Source: Survey Data

both men and women in the drier and poorer North, and lowest in the East. This reflects the substantially higher levels of farm labor which occurred in the North during the June to August labor bottleneck period. During this period the average Northern adult male worked 144 hours per month on his farm compared with 104 and 97 hours per month in the South and East respectively. In contrast, slack season employment levels for both men and women were nearly identical across regions. The data also show that non-agricultural employment was more important in the South for both men and women, but showed the widest seasonal variation in the North. Finally, hired labor employment was least important in the East where it provided less than 5 percent of total employment for males, compared with approximately 13 percent in both the North and South.

In view of these structural differences in employment among regions, it is hardly surprising that few consistent patterns emerged when examining labor profiles across regional income strata. For example, while the lowest levels of annual employment occurred among poor males in the North and South with the greatest hours recorded for high income males in those regions, in the East employment levels were in fact lowest for high income males, and highest for males in middle income households. The changing composition of employment across income strata also reflects patterns peculiar to each region. Although hours of hired labor show the anticipated though weak inverse relationship with income status in the poorer North and in the East, a direct relationship was evident in the South.

It is particularly important to note the high level of peak season hired labor employment among the poorest households in the North, nearly

21 hours per month, reflecting considerable dependence of the nation's poorest households for employment in weeding operations. It is also notable that in both the South and North non-agricultural employment importantly off-sets underemployment during the slack farming period only among high income households. Indeed the lowest levels of employment were recorded among poor Northern farmers during the dry season--less than 78 hours per month.

Average hours of employment for adult males in Nigeria are presented in Table 5.6. The figures show that overall employment levels were extremely low averaging less than 57 hours per month for the entire year, and less than 97 hours per month during the peak period. It is particularly important to note that when only labor on own fields is considered, low income farmers worked the least hours, less than 70 hours per month even during the busiest months.

As in Sierra Leone, the causes of low on-farm employment among the poorest households is not clear, but probably reflects the combined effects of several factors. First, as in Sierra Leone the calorie shortage experienced by the poorest households may have limited the potential energy output of low income workers. Second, although poor farmers worked the least hours per unit area the marginal value product of labor was lowest among low income workers. That is, declining returns to labor set in at an earlier point in the production function of poorer farmers.[1] And third, in order to generate an immediate cash inflow low income males

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[1] Factors contributing to the lower productivity of low income farmers are examined in some detail in Chapter VII.

allocated a substantial proportion of their labor time to off-farm activities. On an annual basis, low income males spent 34 percent of their total work time in off-farm activities, compared to only 14 percent among males in each higher income stratum. And during the peak farming months, when their cash and food reserves were at a minimum, low income males allocated 22 percent of their work time off the farm. This compared to less than 5 percent among adult males in higher income households.

In view of the low overall employment levels, it might be argued that labor time as such was not a significant constraint limiting incomes among poor farmers. However, two additional factors must be considered. Time engaged in job search activities and in travel to and from off-farm employment were not accounted for in either survey. If such activities consumed a substantial amount of time, then the available labor time for low income workers may have been considerably less than is implied in these figures. Second, the competition between farm and off-farm work consisted not only of restrictions on the total hours available for own farm work, but also <u>when</u> such work could be done. To secure regular wage employment, it was necessary that laborers be available when requested, thus interrupting or postponing operations on their own fields. The effect that work discontinuity may have had on the farming productivity of lower income households is examined in Chapter VII.

Capital Use

Typical of much of West Africa, the farming systems observed in both Sierra Leone and Nigeria generally embodied traditional hand tool

technologies, and as a result and level of capital use was extremely low. With the exception of a small number of mechanized farmers in the Bolilands (7 household observations) and Riverain Grasslands (14 households) in Sierra Leone, the use of capital equipment to substitute for labor in farming was extremely limited. Tractors were used in these areas primarily for ploughing and harrowing of rice fields.[1]

The stock value of farm tools per household averaged Le 21.45 for all Sierra Leone farmers, representing an average annual user cost of only Le 2.51[2] (Table 5.7). The stock value of farm tools in Nigeria was even lower at ₦ 8.55 representing an annualized cost of less than ₦ 1.50 (Table 5.8). It is important to note that non-farm capital stocks per household were roughly double the value of farm equipment in both countries at Le 42.46 in Sierra Leone and ₦ 17.19 in Nigeria.

Farm variable costs shown in Tables 5.7 and 5.8 include the value of fertilizer, seed, machinery hire, and hired labor. Payments to hired labor were the dominant component representing 70 percent of farm variable costs in Sierra Leone and 64 percent in Nigeria. This was followed by seed costs (26 percent in Sierra Leone and 27 percent in Nigeria), machinery

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[1]The financial cost of tractor hire services have been included in Table 5.7 as payments by farmers under variable costs, and include a subsidy of 85 percent [Spencer and Byerlee, 1977].

[2]Annual user costs were calculated as:

$$K = \frac{rV}{1-(1+r)^{-n}}$$

where K is the annual service user cost, V is the acquisition cost of the asset, r is the discount rate, and n is the expected life of the asset.

Table 5.7 USE OF CAPITAL IN FARM AND NON-FARM ENTERPRISES BY REGION AND INCOME STRATA IN SIERRA LEONE (IN LEONE)

	NORTH				SOUTH				EAST				NATIONWIDE			
	Terciles				Terciles				Terciles				Terciles			
	1	2	3	All	1	2	3	All	1	2	3	All	1	2	3	All
1. VARIABLE COSTS																
Per household																
Farm	90	107	116	104	86	99	86	91	46	64	77	63	82	97	96	92
Non-farm	11	24	40	25	6	4	4	5	3	5	4	4	7	18	12	13
Total	87	100	148	129	91	92	14	96	44	65	78	67	79	100	105	96
Per Hectare (farm)	68	55	34	53	43	55	35	46	49	41	29	40	55	52	36	48
2. ANNUAL USER COST																
Per household																
Farm	3	3	2	3	3	3	2	3	2	2	2	2	3	2	2	3
Non-farm	13	14	7	12	3	a	3	2	2	a	1	1	7	6	4	6
Total	15	17	9	14	5	3	5	4	4	3	4	3	10	9	7	8
Per Hectare (farm)	2	2	a	2	2	2	a	2	a	2	a	a	2	2	a	2
3. CAPITAL STOCK																
Per household																
Farm	26	24	22	24	25	18	23	22	11	13	16	13	24	20	21	21
Non-farm	41	83	101	76	20	12	19	16	31	26	13	24	31	52	42	42
Total	66	107	123	100	45	30	42	38	42	39	29	37	54	72	63	64
Per Hectare (farm)	19	23	17	20	14	12	13	13	9	7	6	7	16	15	14	15

[a]Less than one.

Source: Survey Data

Table 5.8 CAPITAL USE IN FARM AND NON-FARM ENTERPRISES BY INCOME STRATA IN NIGERIA (IN NAIRA)

	Income Class							
	Decile		Quintile			Decile		
	1	2	2	3	4	9	10	All
Farm Enterprises								
Value of Capital Stock	6	10	9	5	10	9	13	9
Variable Costs	33	44	74	33	101	67	89	65
Non-Farm Enterprises								
Value of Capital Stock	4	12	24	7	36	3	20	17
Variable Costs	47	175	107	55	334	495	707	242

Source: Survey Data

hire (2 percent, only in Sierra Leone). Chemical and organic fertilizers were an insignificant component in Sierra Leone at less than one percent, but represented 9 percent of variable costs in Nigeria (3 percent inorganic and 6 percent organic). It should be noted that only machinery hire and fertilizer necessarily entailed cash expenditures in Sierra Leone, with the bulk of seed coming from own stocks and hired labor generally paid in-kind. Cash payments for hired labor were considerably more important in Nigeria, where 78 percent of labor costs represented cash expenditures. In almost all instances in Sierra Leone and Nigeria non-farm variable costs reflected cash payments.

Examining capital costs across income strata, the data show that in both countries higher income households held somewhat greater stocks of farm equipment, but the association with income status was not strong. Because most households were hand tool cultivators, the relatively minor variation largely reflects differences in the size of inventories and age of tools rather than in the types of capital employed. Farm variable costs showed a weak positive correlation with income status in Sierra Leone, and a considerably stronger relationship was evident in Nigeria. The latter primarily reflected greater labor hiring among higher income households. The use of both fixed and operating capital in non-farm enterprises was substantially greater among higher income households only in the North of Sierra Leone and in Nigeria. The very high level of expenditures incurred by high income households in Nigeria represented participation in highly profitable dry season trading activities. In the North of Sierra Leone these generally reflected expenses incurred in salt water fishing.

In interpreting the capital use figures for both farm and non-farm enterprises, it is important to recall the relatively narrow range of technologies represented in both samples. Thus, the observed variation in capital use with income status reflects primarily the effect of two factors--differences among income strata in enterprise selection, and in scale of operations--both of which were influenced in part by access to capital. Although it is not possible to infer from an examination of use levels alone whether capital shortage posed an important constraint to incomes, the data do suggest that capital availability may have been most closely related to higher incomes through investment in non-farm enterprises and to a lesser extent through labor hiring in farming activities. It is particularly important to note that this was most evident in Nigeria, area of more limited farming opportunities due to greater population density, lower rainfall, and more extended dry season. Further analysis of the effect of capital requirements on the selection of both farm and non-farm enterprises and in turn on returns to labor is presented in the next chapter.

VI. HOUSEHOLD ENTERPRISE COMBINATIONS IN SIERRA LEONE AND NIGERIA

Rural households in both Sierra Leone and Nigeria generally engaged in a wide range of farm and non-farm enterprises.[1] This represented a diversification strategy to minimize the risk of crop failure, a means to spread the demand for labor more evenly throughout the year, as well as an attempt to vary the domestically produced diet. Depending on the cost and returns characteristics of individual enterprises, it is clear that the mix of enterprises could importantly influence aggregate household incomes.

Enterprise combinations were analyzed to test two hypotheses which are central to our understanding of income distribution. First, in view of the wide inter-regional income differences observed in Sierra Leone, we test whether conditions in the poorer and less humid North restricted northern households to engage in a distinct set of low returns enterprises. Because only the Sierra Leone survey included varying ecological conditions, this is examined only in that case study. A second hypothesis is based on the preceeding results which showed that capital use tended to be positively related to household income status. Using data from both Sierra Leone and Nigeria we test whether higher income households engaged in more capital intensive enterprises which in turn generated higher returns to land or labor. Because of differences in the nature of the data between case studies, this chapter examines each country in turn.

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[1] Analysis in this chapter is largely from Franzel [1979] and Matlon [1979].

Sierra Leone

Enterprise Returns

A detailed analysis of budgets and seasonal labor requirements for the major farm and non-farm enterprises in Sierra Leone has been presented in Spencer, Byerlee, and Franzel [1979]. Data on enterprise returns have been abstracted from that study and are summarized in Table 6.1.[1] To facilitate comparison, enterprises have been ranked according to returns to labor and a breakdown of regional returns is provided. The data show that returns tended to be higher in non-farm than in farm enterprises. Of the seven highest returns enterprises, only three--cocoa, mechanized Boliland Rice, and mangrove swamp rice--were farm enterprises, whereas four out of five of the low returns enterprises were upland annual crops produced for home consumption. Moreover, inter-regional comparisons show that returns per hour were consistently lower in the North than in the rest of the country. For example, returns were lowest in the North for upland rice, inland swamp rice, oil palm, and labor sold out, enterprises which account for more than half of rural incomes nationally.

A breakdown of enterprise emphasis among national income strata is shown in Table 6.2. Both hand and mechanized Boliland rice and blacksmithing

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[1] In the calculation of budgets presented in the following sections, only enterprises which represented at least 10 percent of labor or income in at least one percent of households were included. Excluded enterprises include fruits, other vegetables, hunting and gathering, animal production, and other cloth work. The contribution of animals to rural income is procedure was not specifically designed to collect information on income from animal production. Moreover, many cattle farmers are nomadic and thus could not be easily studied.

Table 6.1 FARM AND NON-FARM ENTERPRISES CLASSIFIED ACCORDING TO NET RETURNS PER MANHOUR[a]

Returns Category and Enterprise	Returns to Labor By Region (cents/hour)				Number of Observations
	North	South	East	National	
Low					
Fundi	5.4	-	-	5.4	33
Labor Sold Out	5.9	7.8	7.5	6.9	228
Upland rice	6.9	7.7	10.8	7.9	227
Groundnuts	12.2	5.9	-	9.9	62
Onions-peppers-tomatoes	10.0	-	-	10.0	25
Middle					
Carpentry	-	-	-	12.1	16
Inland Swamp Rice[b]	11.1	15.8	15.8	12.5	46
Coffee	-	-	16.8	16.8	27
Cassava	-	23.7	-	19.9	79
Riverain rice (mech.)	-	23.8	-	23.8	12
Oil Palm (wild)	16.0	28.1	44.8	25.4	120
High					
Blacksmithing	-	-	-	27.7	14
Mangrove rice	-	-	-	27.9	11
Tailoring	-	-	-	32.1	19
Cocoa	-	-	33.5	33.5	13
Boliland rice (mech.)	35.7	-	-	35.7	9
Fishing (saltwater)	36.8	-	-	36.8	13

[a]Only households for which an enterprise accounted for more than 10 per cent of total household labor or income are included in the computation of net returns for that enterprise (exception is labor sold out for which all households selling labor are included). Blanks are shown above where there were less than 10 households in the given region meeting the above criteria.

[b]Figures for the South and East have been combined due to an insufficient number of cases for each region individually.

Source: Survey Data

Table 6.2 ENTERPRISE EMPHASIS AMONG INCOME STRATA IN SIERRA LEONE

	Percent of Households in Which Enterprise:									
	Contributes Greater Than 10% to Labor or Income					Contributes Greater Than 30% to Labor or Income				
	Decile 1	Tercile 1	Tercile 2	Tercile 3	Decile 10	Decile 1	Tercile 1	Tercile 2	Tercile 3	Decile 10
FARM										
Rice										
Upland Rice*	87.5	88.8	76.5	69.4	56.2	87.5	81.6	69.7	61.2	43.7
Inland Swamp	18.8	24.5	27.3	28.6	37.5	9.4	14.3	6.1	9.4	18.7
Mangrove	0	0	1.0	3.1	3.1	0	0	0	3.1	3.1
Boliland rice (hand)*	0	1.0	4.5	7.1	6.2	0	1.0	3.0	4.1	3.1
Boliland rice (mech.)*	0	0	2.3	6.1	6.2	0	0	2.3	5.1	3.1
Riverain rice (mech.)	3.1	3.1	4.5	4.1	9.4	3.1	2.0	3.0	4.1	9.4
Other Annuals										
Fundi*	15.6	16.3	9.8	7.1	6.2	3.1	3.1	2.3	1.0	3.1
Cassava	18.8	25.5	28.8	28.6	25.0	6.2	9.2	7.6	3.1	3.1
Groundnuts*	15.6	19.4	28.8	17.3	18.8	0	0	3.8	3.1	6.2
Onion-Peppers-Tomatoes*	3.1	4.1	12.1	8.2	12.5	3.1	4.1	8.3	5.1	9.4
Other Vegetables*	15.6	16.3	10.6	4.1	6.2	0	1.0	0	0	0
Tree Crops										
Fruits*	0	5.1	2.3	0	0	0	0	0	0	0
Cocoa	6.2	5.1	5.3	8.2	12.5	0	1.0	1.5	2.0	3.1
Coffee	6.2	12.2	9.8	11.2	6.2	0	4.1	1.5	3.1	3.1
Animals	3.1	2.0	0	0	0	0	0	0	0	0
NATURAL RESOURCES										
Wild Oil Palm	37.5	43.9	40.1	36.7	34.4	25.0	23.5	10.6	19.4	15.6
Fishing-Saltwater*	3.1	2.0	8.3	6.1	15.6	0	1.0	5.3	6.1	9.4
Hunting and Gathering	3.1	2.0	2.3	2.0	0	0	1.0	0	0	0
SMALL-SCALE INDUSTRIES										
Tailoring	3.1	4.1	4.5	6.1	15.6	3.1	3.1	2.3	4.1	9.4
Carpentry*	6.2	2.1	4.5	0	0	3.1	1.0	1.5	0	0
Blacksmithing*	0	0	3.8	8.2	3.1	0	0	0.7	5.1	3.1
Spinning-Weaving	0	0	1.5	1.0	3.1	0	0	0	0	0
Other Small Industries	3.1	5.1	3.8	3.0	6.2	0	3.1	0.7	1.0	3.1
TRADING	3.1	1.0	3.8	2.0	0	3.1	2.0	0	0	0
HIRED LABOR*	40.6	39.8	20.5	18.4	21.9	9.4	8.1	4.5	3.1	0

Source: Survey Data

*Indicates that the percent of households in which the enterprise contributes greater than 10 percent to labor or income differs significantly among terciles according to a chi-square test (at the 10 percent significance level).

were significantly more important enterprises among high income households. In contrast, a significantly greater proportion of low income farmers were importantly engaged in upland rice, fundi, other vegetables, fruits, and hired labor. These data indicate rather clearly the importance of upland rice in the farming systems of the lowest income households. Eight-eight percent of households in the poorest decile specialized[1] in that enterprise compared to only 44 percent of households in the tenth decile.

By comparing these results with Table 6.1 earlier the data suggest that enterprise emphasis did contribute to income variation among income strata nationally. For example, with the exception of hand Boliland rice, each of the enterprises emphasized by high income households was classified as a high returns enterprise, whereas all enterprises which were significantly more important among low income households were classified as low returns enterprises.

Impact of Enterprise Choice on Regional and Strata Income Disparities

The effect of enterprise choice on income disparities among regions and across income strata was formally tested through expected returns analysis. The analysis was conducted in two steps. First, the average net return to either land or labor was calculated for the sample subset within which a comparison was being made. Second, average group (either region or income strata) returns to each factor were computed as the weighted mean of enterprise returns, with weights derived from the amount

[1]Allocated 30 percent or more of their labor to upland rice or derived at least 30 percent of their income from that enterprise.

of each factor used in that enterprise by that group.[1] The resulting figures highlight differences among groups in factor returns based on the choices of enterprise which are characteristic of those groups while reducing the effect of differences in productivity across groups within each enterprise.

The results of the analysis on returns to labor are shown in Table 6.3. For farm enterprises alone significant regional variation in returns were found with returns highest in the South at 13.6 cents per hour and lowest in the North at 10.7 cents per hour. When non-farm enterprises are added the regional rankings were identical, with returns again highest in the South (14.0 cents per hour) and lowest in the North (11.8 cents per hour). These results indicate that ecological conditions not only affected the returns to individual crops, but also affected aggregate profitability by restricting the types of crops grown, with both impacts adversely affecting Northern households.

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[1] Algebraically, expected returns were defined as follows:

$$N_{ks} = \sum_{j=1}^{n} \left[\sum_{i=1}^{m} (a_{ijks} \cdot b_{ikt}) \right] \Big/ n$$

where

N_{ks} = Expected net margin to factor k in strata s

a_{ijks} = Percent of total input of factor k employed on enterprise i of household j in strata s.

b_{ikt} = Average overall net margin to factor k in enterprise i within strata t

and where s is a subset of t.

Table 6.3 EXPECTED RETURNS TO LABOR BY REGION AND INCOME STRATA IN SIERRA LEONE (CENTS/HOUR)

Region	Farm Enterprises Only[a]						All Enterprises[b]					
	Decile 1	Tercile 1	Tercile 2	Tercile 3	Decile 10	All	Decile 1	Tercile 1	Tercile 2	Tercile 3	Decile 10	All
North	9.6	8.7	11.0	9.7	10.4	10.7	8.3	8.7	11.4	12.8	12.5	11.8
South	13.6	12.8	12.3	14.1	19.3	13.6	12.2	12.9	12.7	15.0	18.5	14.0
East	-	14.8	14.8	15.2	-	12.3	-	15.2	15.0	15.5	-	12.8
National	10.7	11.3	12.5	12.7	15.1	12.2	10.8	11.4	13.2	13.9	16.5	13.9

Source: Survey Data

[a]Analysis of variance indicated significant variation (at the 5 percent level) among regional returns and among tercile returns in the North only.

[b]Analysis of variance indicated significant variation (at the 5 percent level) among regional returns and among tercile returns nationally and within the North and South.

Examining variation among income strata, few consistent differences were found for farm enterprises alone. However, with the inclusion of non-farm enterprises the analysis revealed a consistent and significant variation between expected returns to labor and income status, nationally as well as in the North and South. The extremely low expected returns for low income farmers in the North--only 8.7 cents per hour--is particularly important. This suggests that a critical cause of absolute poverty in that region was the set of enterprises which the poorest households were able to pursue given available resources.

Although it is clear that enterprise emphasis contributed to observed disparities, it is also evident that the effect was generally minor. For example, while the average income in the East exceeded the mean in the North by 37 percent, expected returns to labor differed by only 19 percent. The relatively small role that enterprise mix plays in explaining income differences among income strata is also important to note. For example, although the income per capita of the richest decile of households nationally was nearly 15 times that of the poorest decile, expected returns to labor differed by only 53 percent.[1]

Factors Affecting Enterprise Choice Among Income Strata

Further analysis identified several factors which contributed to the observed variation in enterprises across income classes. Identification

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[1]When similar computations were made for land, no relationship was evident between expected returns to land and income status [Franzel, 1979]. However, as previous analysis has shown, since the land is probably not a constraining factor in Sierra Leone, it is less likely that farmers would choose enterprises to maximize returns to land.

of these factors is important not only for understanding the current allocation of resources, but also can be useful in inferring income-related constraints to future changes in farming systems either through the adoption of new production techniques or through change in enterprise mix.

Two sets of factor/factor ratios were examined--relative land or labor intensity and capital requirements--to test the hypotheses set out earlier: (1) that enterprises which require greater capital use resulted in higher returns to labor and (2) that lower income households choose enterprises which required lower use of capital. To examine these relationships, three capital/labor ratios were calculated for both farm and non-farm enterprises. These are presented in Table 6.4. The capital stocks measure represents the barrier to entry in any given enterprise, whereas cash expenditure and variable costs per man hour have been included to reflect the possible importance of a liquidity or other operating capital constraint restricting participation.

The data show that substantially lower capital costs per man hour were generally associated with farm as compared to non-farm enterprises. Enterprises which required high capital use include marine fishing, tailoring, cocoa, and mechanized Boliland rice production. The lowest capital requirements were observed for cassava, fundi, onions, peppers and tomatoes, oil palm, and hand boliland rice. Comparing these results with Table 6.1 earlier, it is clear that enterprises which used greater inputs of capital per hour, generally realized higher returns to labor. Five of the seven enterprises included in the high returns category also ranked high (were among the top seven enterprises) in at least two of

Table 6.4 CAPITAL COSTS PER HOUR BY TYPE AND ENTERPRISE IN SIERRA LEONE (CENTS/HOUR)[a]

Enterprise	Variable Costs	Cash Expenditures	Capital Stocks
FARM			
Rice			
Upland	2.5	0.4	.23
Inland Swamp	2.8	0.5	.21
Mangrove	4.1	0.7	.18
Boliland (hand)	2.9	0.3	.21
Boliland (mech.)	8.8	5.3	.21
Riverain (mech.)	4.5	3.0	.42
Other Annuals			
Fundi	1.1	0.1	.23
Cassava	.8	0.1	.25
Groundnuts	1.8	0.1	.23
Onions-Peppers-Tomatoes	1.2	0.1	.17
Tree Crops[a]			
Cocoa	.9	0.6	.22
Coffee	.6	0.2	.24
Oil Palm	.8	0.3	.23
NON-FARM			
Marine Fishing	13.6	12.1	44.60
Tailoring	1.5	1.5	22.79
Carpentry	1.8	-	16.60
Blacksmithing	1.5	1.4	7.50

[a]Tree crop establishment costs have not been counted as capital stock in this table.

Source: Survey Data .

the three capital use measures. Moreover, the data show that the association between capital use and enterprise returns was closest within non-farm than within farm enterprises.

A procedure analogous to that applied in calculating expected returns to labor was used to determine whether the enterprise combinations of the various income strata reflected consistent and significant relationships between capital use per labor hour and income status.[1] The results are summarized in Table 6.5.

Examining farm enterprises alone, for both variable costs and capital stocks, expected capital costs were not significantly associated with income status. Indeed, an unexpected but insignificant inverse correlation was evident. This indicates that capital requirements probably did not influence differences in farm enterprise selection among households across income strata.

However, with the addition of non-farm enterprises, the analysis revealed highly significant variation in expected capital stock costs across income strata, indicating that higher income households selected substantially more capital intensive non-farm enterprises than did poorer households. For example, for both farm and non-farm together, the expected value of capital stocks per man hour for the highest decile was about five times greater than that of the poorest decile, and the corresponding margin between extreme terciles was three to one. In contrast, no relationship was evident between expected variable costs

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[1] Similar analysis examining the relationship between expected land/labor ratios and income status found no significant variation across income groups [Franzel, 1979].

Table 6.5 EXPECTED CAPITAL/LABOR RATIOS BY REGION AND INCOME STRATA IN SIERRA LEONE

Capital Measure	Region	Farm Enterprises Only[a]						All Enterprises[b]					
		Decile	Tercile			Decile		Decile	Tercile			Decile	
		1	1	2	3	10	All	1	1	2	3	10	All
Variable Costs/Hour (in cents)	North	2.04	1.93	1.88	1.51	1.43	1.77	2.06	1.99	2.24	2.34	2.29	2.13
	South	2.15	2.20	2.19	2.09	1.88	2.16	2.18	2.24	2.26	2.22	2.19	2.22
	East	1.47	1.72	1.98	2.13	1.95	1.95	1.59	1.83	2.03	2.14	1.96	2.01
	National	2.21	2.04	1.96	1.85	1.83	1.95	2.24	2.10	2.28	2.12	2.30	2.14
Capital Stocks/Hour (in Leone)	North	.19	.19	.18	.14	.12	.17	.35	.44	1.70	3.40	3.62	1.82
	South	.24	.24	.24	.23	.23	.24	.52	.48	.64	1.30	2.91	.70
	East	-	.19	.21	.22	-	.21	-	.36	.72	1.40	-	.82
	National	.22	.21	.20	.19	.19	.20	.55	.53	1.48	1.45	2.69	1.23

Source: Survey Data

[a]Analysis of variance indicated significant variation (at the 5 percent level) among regional capital stock/labor ratios and among tercile ratios nationally and in the North. No significant differences were found for expected variable costs.

[b]Analysis of variance indicated significant variation (at the 5 percent level) among regional capital stock/labor ratios and among tercile ratios nationally and in the North and East. No significant differences were found for expected variable costs.

per labor hour and income. These results clearly indicated that the cost of capital stocks, but not variable costs, posed a key constraint limiting the participation of low income households in high return off-farm activities. The policy implications of entry capital constraining the nature and scale of off-farm activities among poor households is examined further in Chapter VIII.

Nigeria

Data from the Nigerian survey were also examined to determine whether the mix of both farm and non-farm enterprises showed any consistent patterns across income strata, and whether these patterns implied corresponding variation in enterprise mix profitability. Due to differences in the available data and in the cropping systems characteristic of the Sierra Leone and Nigerian study areas, however, different analytical procedures were applied. In particular it was not possible to measure crop emphasis in terms of the allocation of either land or labor, or in terms of net income.[1] Rather, primary reliance was placed on the proportion of total harvest value represented by each crop.

Table 6.6 presents this measure of cropping emphasis for the twelve major crops in the area. The similarities in crop allocation among income strata are striking. With the exception of rice, sugarcane, and root crops, each crop was produced by households in each strata, and in

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[1]Because of the high degree of inter-cropping and due to the wide variety of crop mixtures, except for planting and harvest activities few labor inputs could be assigned to a specific crop. Similarly, neither the fertilizer nor and land allocated to individual crops could be accurately determined.

Table 6.6 THE HARVEST VALUE OF 12 MAJOR CROPS EXPRESSED AS A PERCENT OF THE TOTAL HARVEST VALUE BY INCOME STRATUM IN NIGERIA[a]

Income strata	Early millet	Late millet	Tall sorghum	Short sorghum	Maize	Rice	Cowpea	Groundnut	Onion	Pepper	Sugar cane	Root crops	Total
Decile 1	7.8	2.1	18.5	13.4	1.5	-	2.4	50.0	0.5	1.8	-	-	98.0
" 2	7.7	2.3	18.7	17.4	1.7	3.1	3.1	31.1	4.9	3.0	-	2.3	95.3
Quintile 2	6.4	1.1	30.2	7.1	1.4	1.1	3.5	31.2	4.3	5.1	4.2	0.6	96.2
" 3	7.2	1.9	27.5	10.3	1.7	0.9	3.0	24.9	3.7	5.7	1.6	6.9	95.3
" 4	6.5	1.5	24.1	3.7	0.6	2.7	2.7	37.2	5.6	5.0	6.7	2.4	98.7
Decile 9	5.2	1.1	26.4	11.1	1.2	1.1	5.4	33.0	5.6	6.1	-	0.8	97.0
Decile 10	7.2	2.2	24.5	7.9	1.2	2.2	3.9	26.6	4.8	9.4	6.1	0.7	96.7
All	6.8	1.7	25.3	8.2	1.2	1.7	3.4	32.3	4.6	5.6	3.7	1.3	95.8
					Relative Cropping Emphasis Index[b]								
Decile 1	1.15	1.25	.73	1.63	1.25	-	.71	1.55	.11	.32	-	-	
" 2	1.13	1.35	.74	2.12	1.42	1.82	.91	.96	1.07	.54	-	1.77	
Quintile 2	.94	.65	1.19	.87	1.17	.65	1.03	.97	.93	.91	1.14	.46	
" 3	1.06	1.12	1.09	1.26	1.42	.53	.88	.77	.80	1.02	.43	5.31	
" 4	.96	.88	.95	.45	.50	1.58	.79	1.15	1.22	.89	1.81	1.84	
Decile 9	.76	.65	1.04	1.35	1.00	.65	1.59	1.02	1.22	1.09	-	.62	
" 10	1.05	1.29	.97	.96	1.00	1.29	1.14	.82	1.04	1.68	1.65	.54	

[a]Percentages have been calculated as weighted means.

[b]The relative cropping emphasis index has been calculated as the ratio of the percentage harvest value of each crop in each income class to the overall percentage harvest value for the respective crop. Values greater than one represent greater than average emphasis to a particular crop, while values less than one reflect lower than average emphasis.

Source: Survey Data

roughly similar proportions. The widest absolute range in production shares is evident for the cash crop groundnut. Crops which comprised a greater than average share of harvest value among the poorest households with generally decreasing shares as incomes increase throughout the income range, include the subsistence crops early millet, short sorghum, and maize. Crops which show the opposite pattern, that is lower than average share in total harvest value among households in the lowest strata and a generally increasing share in the upper income strata, include cowpea and the cash crops, onion, pepper, and sugarcane. The considerable importance of the cash crop groundnut in the cropping system of the poorest decile, 50 percent of total harvest value, should be noted in particular.

Impact of Crop Enterprise Choice on Income Disparities

The data problems cited above prevented an identical application of expected returns analysis as used in the Sierra Leone. However, a modified procedure described elsewhere [Matlon, 1979] found that variation in crop mix on inter-strata differences in returns to both land and labor was even less important than in the Sierra Leone case. Moreover, there was no consistent trend across income strata.

Factors Affecting Crop Choice Among Income Strata

Although analysis indicated that the selection of crop enterprises had a negligible influence on overall income inequality in the Nigerian case, further analysis was conducted to explain the considerable emphasis given to the cash crop groundnut among the poorest households. Through an analysis of variance procedure, it was found that each of the four

cash crops in the area--sugarcane, onion, pepper, groundnut--ranked among the five most profitable crops with respect to land and, with the exception of pepper, to labor[1] [Matlon, 1977]. In contrast, the basic food staple, sorghum, ranked among the least profitable of the 12 major crops according to both measures. An examination of factor requirements showed further that sugarcane, onion, and pepper were associated with the highest rates of fertilizer application and the highest cash requirements for the purchase of seeds or cuttings. In contrast, groundnut production incurred considerably lower variable costs, and sorghum was associated with the lowest operating capital requirements of all major crops.

These cost and returns characteristics provide a likely explanation for the emphasis given to groundnut among lower income households. In meeting domestic consumption needs calories either can be directly produced through the cultivation of food crops, or they can be obtained through the production and sale of cash crops with subsequent purchases of food in the market. Given a limited food production potential (due to low land use and low productivity) such that domestic production of household food requirements was unattainable regardless of cropping emphasis, the lowest income households allocated greater land and labor to the production of the most profitable crop compatible with their low capital position, groundnut. Analysis showed that revenues received from the sale of groundnut permitted a higher level of consumption through

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[1]Crops for which greater than 70 percent of output was sold were defined as cash crops. The profitability measures employed were gross margins per hectare and per labor hour.

subsequent grain purchases than if the entire land base had been allocated to less profitable food staples alone [Matlon, 1977]. Groundnut was made even more attractive to low income producers since it was the only crop for which there was an assured demand and an established price determined by marketing board purchases, thereby reducing the uncertainty of price variation. It is important to realize, however, that the groundnut strategy placed the poorest households in a tenuous position of dependence on higher income surplus grain producers in meeting their basic food needs.

Reasons for the declining share of groundnut as one moves above the poorest decile are less clear, but probably reflect a change in production objectives. Although there is no direct social prohibition among the Hausa which limits a household's purchases of grain in the market--indeed, grain purchases were observed among all strata--dependence on the market to meet household requirements is socially discouraged. The largest production shares of the major staple, tall sorghum, occurred in the second and third quintile. Given a more ample land base, middle income households were able to meet a self-sufficiency objective, thereby reducing their dependence on the market, but only by decreasing their groundnut plantings. Thus self-sufficiency was attained by middle income farmers, but only by shifting to a less profitable crop mix. That is, with a sacrifice in aggregate income.

Impact of Non-Farm Enterprise Choice on Income Disparities

Variation in the types of non-agricultural activities pursued by Nigerian households across income classes was also examined by disaggregating

48 off-farm occupations according to the distribution of each occupation's market share among income classes.[1] Analysis showed that characteristics of non-agricultural occupations shifted systematically with household income status. All enterprises in which low income households tended to specialize were service occupations employing little or no cash expenditure. In contrast the number of occupations requiring substantial inputs of capital increased directly with the income category.

Of particular interest was the distribution of earnings obtained from three food related occupations--trading in local crops, trading in processed foods, and selling roasted meat. For each of these enterprises over 80 percent of gross sales occurred among households in the highest two quintiles. The annual cash outlays associated with these activities were correspondingly substantial varying between ₦ 225 and ₦ 350 per household. These data indicate rather clearly, then, that lower income households were dependent upon the highest income households not only for the production of surplus food goods, but also for marketing services. This suggests that if an income-based class structure were to develop with a parallel decline in in existing communal support institutions, at least some of the preconditions for an exploitative system of exchange already exist at the village level.

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[1] If all gross sales of an occupation's products or services came from the lowest (highest) two income quintiles, the occupation has been included in the "Only Low (High) Income" category. If 75 percent or more, but less than 100 percent, of total gross sales occurred in the lowest (highest) two quintiles, the occupation was categorized as "Low (High) Income Biased." An occupation was categorized as "Intermediate" if it did not quality in these other classes; that is, if less than 75 percent of total sales occurred in households falling within either the lower or upper two income quintiles. See Matlon [1979] for a fuller discussion of the analysis of non-farm occupations in northern Nigeria.

Since hourly labor data were not collected among the large sample households, it was not possible to calculate returns to labor for each type of off-farm activity directly. Such data were obtained, however, for 23 occupations from the 35 households in the small sample. Table 6.7 summarizes returns to labor in off-farm enterprises disaggregating occupations according to the income bias categories derived from the large sample. The data show that average returns to labor were consistently higher among those occupations pursued by higher income households.[1]

Comparison of Case Study Results

In summary, analysis of household enterprise combinations in both Sierra Leone and Nigeria showed that the selection of cropping activities did not contribute importantly to income disparities between low and high income households. Within Sierra Leone, expected returns analysis revealed relatively low correlation between income status and crop mix profitability, and no association with expected capital use. Although a number of cash crops characterized by greater variable costs and high returns were somewhat more important in the cropping systems of higher income households in the Nigerian case, because inter-strata variation in cropping emphasis was relatively minor and because of the unique role

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[1] Average hourly returns were calculated as the net cash flow, plus additions to stocks valued at purchase prices, less depletions in stocks valued at sales prices, divided by the total hours worked by all household members. Depreciation of capital equipment were not costed. However, since most activities involved little or no fixed capital and equipment, the results are not importantly affected.

Table 6.7 AVERAGE RETURNS PER HOUR REALIZED IN 23 OFF-FARM OCCUPATIONS DISAGGREGATED BY INCOME BIAS CATEGORY, SMALL SAMPLE[a] (IN NAIRA)

Income bias category[b]	Occupation	No. of household observations	Average return per labor hour (in Naira)
Low income only	Callabash cutting	1	.087
	Total	1	.087
Low income bias	Trading provisions	1	.071
	Tailoring	1	.203
	Selling grass	3	.064
	Hauling water	1	.115
	Total	6	.138
Intermediate	Cap making	1	.154
	Groundnut decortication	1	.085
	Selling firewood	8	.132
	Washing clothes	1	.075
	Trading kola nuts	2	.128
	Trading used clothes	1	.151
	Trading cloth	1	.268
	Transporting soil[c]	4	.193
	Transporting crops[c]	1	.140
	Mat making	1	.125
	Total	21	.154
High income bias	Barber	2	.151
	Praise singer/musician	2	.088
	Crop trading agent	4	.259
	Building construction	5	.110
	Sugar cane processor	1	.315
	Trading groundnut oil	1	.043
	Total	15	.195
High income only	Bicycle transport	1	.075
	Bicycle rental	1	.439
	Total	2	.309
	Total	45	.148

[a]Average hourly returns for each occupation were calculated by dividing aggregate earnings by the total hours worked in the respective occupation or occupational category.

[b]See footnote 1, page 120 for definition of Income Bias Categories.

[c]With donkey.

Source: Survey Data

played by groundnut in that area, the net impact of cropping emphasis on incomes was also negligible. Given current production technologies we can conclude there is little scope for improving the incomes of the poorest households through changing cropping combinations toward combinations characteristic of higher income farmers.

In contrast to the results of the crop mix analysis, the selection of non-farm enterprises was found to contribute significantly to observed income disparities in both case studies. The data showed that higher income households were more heavily engaged in non-farm enterprises which required greater capital imputs and which as a result generated greater returns to labor. Moreover, because of a lack of fixed capital in Sierra Leone and working capital in Nigeria, poorer households were systematically excluded from the most profitable types of non-farm employment. The policy implications of capital as a constraint limiting the nature and scale of non-farm activities is examined further in Chapter VIII.

VII. RESOURCE PRODUCTIVITY IN SELECTED FARM ENTERPRISES

Previous chapters have shown that although factor endowments, especially land and household composition, were somewhat less favorable among the poorest households, the magnitude of these differences in both case studies was minor when compared to corresponding income differentials. Similarly, while the selection of and level of participation in non-farm enterprises were found to contribute significantly to income disparities, contrasted with these disparities the magnitude of the effect was relatively minor. Given these results, variation in resource productivity within the major enterprises emerges as a potentially critical factor determining income differentials.

Historically, most studies of productivity have focussed on the relationship between factor returns and the choice of technique. Within agriculture, such research has emphasized the impact of improved biochemical and mechanical technologies on changing returns to land and labor. As described in Chapter II, however, the degree of such technical change in rural Sierra Leone and in northern Nigeria has been very limited.[1] This does not, of course, imply that variation in production

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[1] Data were obtained on two "improved" farm technologies in the Sierra Leone survey--mechanized rice cultivation in the Bolilands, and a biochemical inland swamp rice package introduced in the Moa Basin. The latter was part of an Integrated Agricultural Project established in 1973. Although IADP farmers were not part of the national random sample they were purposively selected for special study. An analysis of both improved technologies is included in Chapter VIII under a more general discussion of choice of technique.

technique either does not occur or is unimportant. Within the traditional agricultural systems examined, where all operations are manually performed and where the use of purchased inputs is negligible, there nevertheless exist important differences in land preparation methods, timing and method of planting, local seed varieties, density of intercropping, rotation practices, timing and intensity of weeding, and in the extent of water control, each of which may produce substantial productivity differentials.

The importance of identifying the nature and causes of technique related productivity differentials within traditional farming systems is clear, particularly if it can be shown that variation is related to farm income class. Such knowledge can contribute importantly to the development of improved technologies which are compatible with the objectives, resources and economic circumstances of the low income farmer. Although some farm level research has explored the proximate causes of efficiency variation among traditional producers in Africa, none have placed their results in a distribution context.

The Sierra Leone and Nigeria data sets differ importantly in the degree to which they could be used to examine these relationships. The Sierra Leone farm survey did not attempt to capture specific differences in cultural practices. However, because a wide range of locations was included in that survey, the effect of environmental factors--such as population density--on farm productivity can be examined. The Nigerian data set was somewhat better suited to examine technique related causes of variation in farm productivity since considerably greater detail describing cultural practices was obtained in that survey.

Sierra Leone

Results of Budget Analysis

Only two enterprises in Sierra Leone, upland rice and inland swamp rice, had a sufficient number of observations to permit the disaggregation of farm budgets into regional income strata. In terms of land use, these were the two most important crop enterprises representing approximately 62 percent and 6 percent of total farmed area, respectively. Farm budgets constructed for both enterprises by region and income strata are presented in Tables 7.1 and 7.2.

The budgets for upland rice show that although yields were generally lowest in the North, within each region output levels were consistently lowest on the fields of the poorest households and highest on those of the richest households. For example, in the North where income inequality was highest, average yields for third tercile farmers were more than 140 percent greater than yields of first tercile farmers; in the South, this margin was 70 percent; and in the East it was 30 percent. However, an important finding is that data on production costs failed to explain these wide production differentials. The intensity of land use, as reflected in both labor inputs and in variable costs did not vary consistently among income strata. As a result differences in returns to household labor and management among income strata were substantial. Thus again comparing extreme terciles, returns per hour of family labor varied in the North between 3.0 and 10.7 cents per hour; in the South these figures were 2.5 and 13.0 cents per hour; and in the East 7.9 and 15.5 cents per hour.

The budget analysis of inland swamp rice production revealed even more interesting results. As with upland rice, substantial yield

Table 7.1 BUDGETS FOR UPLAND RICE BY REGION AND INCOME CLASS IN SIERRA LEONE

	NORTH				SOUTH				EAST				NATIONAL			
	Tercile				Tercile				Tercile				Tercile			
	1	2	3	All	1	2	3	All	1	2	3	All	1	2	3	All
I. Financial & Economic Analysis																
A. Basic Data																
1. Number of cases	20-	21-	10-	51-	26-	36-	26-	88-	12-	13-	10-	35-	62-	69-	52-	183-
2. Average Size (Hectares)	1.9	2.9	3.1	2.5	1.7	2.3	2.6	2.2	1.0	1.5	1.7	1.4	1.6	2.2	2.5	2.1
B. Costs & Returns																
3. Value of Output (Le/Ha)																
a) Value of Rice	82.00	120.67	205.90	122.22	79.23	115.48	147.56	114.25	152.25	174.89	201.23	174.64	96.81	142.91	166.47	128.74
b) Value of Inter-crop	3.58	3.11	2.42	3.16	3.93	16.00	10.02	10.67	.54	7.14	4.00	4.00	2.05	9.68	8.69	7.11
c) Total Value of Output	85.58	123.78	208.42	125.38	83.16	131.48	157.58	124.91	152.79	182.02	205.23	178.64	98.86	152.59	175.16	135.85
4. Variable Costs (Le/Ha)																
a) Seed	8.17	7.16	6.94	7.51	8.99	10.10	6.89	8.84	15.21	15.31	9.63	13.65	10.94	10.59	8.62	9.41
b) Fertilizer	.05	.17	0	.10	.22	.02	0	.07	0	0	0	0	.17	.02	0	.07
c) Hired Labor	22.05	16.99	25.26	20.59	27.21	31.38	20.37	26.91	26.15	26.91	28.37	26.86	40.02	26.22	23.01	25.06
d) Total Variable Costs	30.32	24.32	32.20	28.20	36.42	41.51	27.26	35.83	41.36	42.22	37.26	40.52	36.32	36.84	31.63	34.54
5. Gross Margin (Le/Ha)	35.31	99.46	176.22	97.19	46.72	89.98	130.32	89.09	111.43	139.80	167.98	138.12	62.54	115.75	143.53	100.49
6. Tools & Equipment (Le/Ha)	.44	.30	.47	.40	1.33	.89	.40	.96	.79	.91	.67	.81	1.11	.62	.79	.72
7. Net Margin to Household Labor, Land & Management (Le/Ha)	54.86	99.16	175.75	96.79	45.38	89.09	129.93	88.12	110.64	138.89	167.31	137.31	61.43	115.14	142.74	99.78
8. Land Payments (Le/Ha)	3.09	1.04	.74	1.85	4.07	3.85	2.22	3.48	0	0	0	0	2.52	2.35	1.56	.77
9. Net Margin to Household Labor & Management (Le/Ha)	51.78	98.12	175.01	94.94	41.31	85.23	127.70	87.70	110.64	138.89	167.31	137.31	58.91	112.79	141.19	91.60
10. Net Margin to Household Labor & Management (¢/Hr)	3.0	6.7	10.7	6.0	2.5	4.8	13.0	5.8	7.9	9.5	15.5	10.3	3.5	7.3	11.4	1
II. Technical Data																
1. Rice Yield (Kg/Ha)	489	711	1192	719	581	771	979	776	778	895	1029	894	558	826	981	783
2. Seed Rate (Kg/Ha)	48	41	39	44	66	67	47	62	77	77	49	69	62	62	52	58
3. Fertilizer use (Kg/Ha) (lbs by farmers using 20-20-20 fertilizer)	21	82	0	53	68	11	0	50	0	0	0	0	60	11	0	6
4. % of farmers using fertilizer	5.0	4.8	0	1.9	7.7	2.8	0	4.5	0	0	0	0	6.7	1.5	0	8
5. Total labor (Hrs/Ha)	2084	1733	2044	1926	1951	2131	1225	1832	1723	1973	1420	1659	1990	1874	1526	1830
a) Family	1723	1454	1632	1590	1627	1758	983	1511	1390	1459	1079	1328	1672	1543	1235	1514
b) Hired	361	279	412	336	324	373	242	321	333	514	341	331	318	331	291	316
c) Percentage Hired	17-	16-	20-	17-	17-	17-	20-	18-	19-	19-	24-	20-	16-	18-	19-	17-
6. Enterprise Wage Rate	.061	.061	.061	.061	.084	.084	.084	.084	.081	.081	.081	.081	.079	.079	.079	.079
7. Farm gate price	4.60	4.60	4.60	4.60	3.76	3.76	3.76	3.76	5.32	5.32	5.32	5.32	4.42	4.42	4.42	4.42

Source: Survey Data

Table 7.2 BUDGETS FOR INLAND SWAMP RICE BY REGION AND INCOME CLASS IN SIERRA LEONE

	NORTH				SOUTH				EAST				NATIONAL			
	Tercile				Tercile				Tercile				Tercile			
	1	2	3	All	1	2	3	All	1	2	3	All	1	2	3	All
I. Financial & Economic Analysis																
A. Basic Data																
1. No. of cases	12	12	11	35	2	5	3	10	2	3	3	8	17	23	13	53
2. Average size (Hectares)	.71	.52	.84	1.70	1.49	.47	1.09	.84	.23	.35	.61	.41	.42	.57	.85	.67
B. Cost & Return																
3. Value of output (Le/Ha)	278.54	339.87	272.66	290.94	152.69	378.53	251.45	251.10	128.29	468.68	625.92	459.12	280.96	281.36	335.43	297.34
4. Variable Cost (Le/Ha)																
a) seed	13.28	47.48	34.35	31.63	5.46	18.72	7.33	12.67	9.09	14.74	10.57	11.75	11.88	35.95	22.99	25.06
b) fertilizer	5.51	4.69	.20	3.56	0	0	.10	.02	0	0	0	0	5.26	1.43	.17	2.07
c) Hired Labor	25.11	34.47	28.17	28.89	13.48	27.93	15.21	20.49	33.93	1.23	3.58	14.12	30.69	18.86	12.64	21.21
d) Total variable cost	43.90	86.64	62.72	64.07	18.94	46.64	22.64	33.19	43.41	15.98	14.15	35.88	47.23	56.25	35.80	48.94
5. Gross Margin (Le/Ha)	234.54	253.11	209.85	226.77	133.70	331.74	228.72	217.83	94.32	452.54	454.37	433.09	233.04	225.01	299.51	248.30
6. Tools & Equipment (Le/Ha)	1.65	1.58	.96	1.38	1.56	.49	1.56	.96	.37	.12	.17	.22	1.14	.69	.54	.79
7. Net Margin to Household Labor, Land & Management (Le/Ha)	233	252	209	225	132	331	227	217	94	452	454	433	232	224	299	248
8. Land Payments (Le/Ha)	8.17	17.26	3.70	10.05	0	.37	4.40	1.51	0	0	0	0	5.85	9.80	2.74	6.81
9. Net Margin to Household Labor & Management (Le/Ha)	225	234	205	215	132	331	223	215	94	452	454	433	226	215	296	241
10. Net Margin to Household Labor & Management (¢/hr)	9.5	7.5	16.4	10.1	8.3	9.0	26.9	11.5	3.7	23.2	27.2	23.9	9.8	8.2	22.7	11.5
II. Technical Data																
1. Yield (Kg/Ha)	1858	2321	3270	2326	1613	2061	2414	2039	685	2103	2853	2221	1907	2371	2609	2250
2. Seed rate (Kg/Ha)	75	303	200	193	47	146	49	96	46	75	54	59	69	226	139	155
3. Fertilizer use (Kg/Ha) (lbs by farmers using 20-20-20 fertilizer)	303	255	48	129	0	0	7	1	0	0	0	0	294	250	27	246
4. % of farmers using fertilizer	39	36	7	28	0	0	17	5	0	0	0	0	22	7	6	12
5. Total labor (Hrs/Ha)	2679	3568	1637	2496	1728	4015	998	2094	2941	1965	1714	1973	2674	2842	1462	2356
*a) Family	2304	3121	1272	2121	1578	3701	827	1864	2541	1941	1672	1807	2296	2610	1306	2094
*b) Hired	375	447	365	375	151	314	170	230	400	15	42	165	378	232	156	262
c) Percentage Hired	12	13	22	15	9	8	17	11	14	1	3	8	14	8	10	11
6. Enterprise wage rate	7.7	7.7	7.7	7.7	8.9	8.9	8.9	8.9	8.5	8.5	8.5	8.5	8.1	8.1	8.1	8.1
7. Farm gate price	4.52	4.52	4.52	4.52	4.01	4.01	4.01	4.01	5.41	5.41	5.41	5.41	4.32	4.32	4.32	4.32

Source: Survey Data

differentials among income strata were again evident, with yields consistently lowest on the fields of the poorest households. But most importantly indicators of land use intensity were in fact highest among the poorest producers. For example, the poorest farmers in the North expended on average 2680 hours per hectare compared to 1640 hours among the richest tercile; in the South these figures were 1730 and 1000 hours, respectively; and in the East 2940 and 1710 hours. Similarly, although fertilizer use was observed only in the North, use rates showed an unexpected strong inverse correlation with income. Within that region 39 percent of first tercile farmers applied inorganic fertilizers compared with only 7 percent of those in the third tercile. As a consequence returns to all factors reflect consistently wide differentials between low and high income households.

The Effect of Population Density on Factor Returns

In short, the budget data on upland and inland swamp rice suggest that differences in intensity of factor use and in production technology do not explain the observed returns patterns across income strata. Further analysis permitted a partial test of the effect of soil quality variation associated with location. Although man/land ratios were generally low throughout most of Sierra Leone, with recent population growth pockets of high population density have begun to emerge. It would be expected that as population pressure increases fallow periods would decrease, which, in the absence of significant fertilization, would lead to a decline in soil fertility and productivity. To test this relationship sample households were divided into two groups on the basis of location in high density

(greater than 40 persons/km^2) or low density (less than 40 persons/km^2) enumeration areas. Within each group, households were selected for which there were sufficient data to analyze costs and returns in upland rice production, and returns to land and labor were compared. The results are summarized in Table 7.3.[1]

As expected the analysis showed that returns to both factors were substantially lower in high density areas, with the widest differences recorded in the North. Within that region returns to land in high density villages were less than 30 percent of levels achieved in low density areas, and returns to labor in villages with higher man/land ratios were only 56 percent of those in low density areas. Similar patterns were evident in the South, but the differences were not significant at the 15 percent level when tested through an analysis of variance.

The proximate causes of these productivity differences, however, were not clear. Although when comparisons were made nationally and in the South, fallow periods tended to be shorter in areas of greater population pressure, the magnitudes of the differences were not significant. Moreover, in the North where productivity differentials were widest, contrary and highly significant fallowing differentials were observed. Finally, labor use patterns revealed an unexpected result that labor inputs per hectare tended to be somewhat greater in low density areas. While this offers a partial explanation of the higher gross margins to land, it makes the labor return differentials between density zones even more significant.

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[1]Note that there were insufficient observations and variation in population density among Eastern enumeration areas to test for differences within that region.

Table 7.3 THE EFFECT OF POPULATION DENSITY ON RETURNS TO LAND AND LABOR IN UPLAND RICE PRODUCTION BY REGION IN SIERRA LEONE

Region and Population Density of Enumeration Area[a]	Gross Margins Per Hectare (Le/Ha)	Returns to Household Labor per Hour (Le/Hr)	Age of Bush (Years)	Total Hours of Labor per Hectare (Hrs/Ha)
National				
Low density	91.69	0.092	10.8	1806
High density	48.26	0.047	9.8	1270
	**	**		
North				
Low density	101.2	0.062	6.9	2680
High density	28.11	0.035	8.4	1969
	*	*	*	
South				
Low density	80.23	0.087	13.2	1881
High density	62.00	0.057	11.3	1608

[a] Low density: <40 persons/km^2.
High density: >40 persons/km^2.

*Differences significant at the 3 percent level.

**Difference significant at the 1 percent level.

Source: Survey Data

In short, lacking additional information it is not possible to identify with certainty the cause of the decline in productivity associated with greater population pressure. What the data may reflect are differentials in land use intensity which occurred during periods previous to the years covered in the scope of the survey. If this is correct, it points to a chronic future decline in both farm productivity and incomes as rural populations continue to grow given existing technologies.

The association between location with respect to population density and income was further tested by cross-tabulating all 328 households in the national sample according to density location and income strata. Applying a chi square test it was found that nationally and within both the North and South a significantly (at the two percent level) greater than average proportion of low income (first tercile) households were located in high density enumeration areas. These results not only underline the critical effect of productivity on incomes variation, but further identify the geographic concentration of poverty households in high density areas.

Nigeria

Results of Budget and Production Function Analysis

Farm budgets for Nigerian farmers summarized in Table 7.4 showed results similar to the Sierra Leone findings.[1] Each measure of productivity--

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[1]Because labor data were obtained only for the small sample of 35 households, budgets were constructed only for those units. Further, to control for general soil type differences only upland fields, which included more than 95 percent of cultivated area in the study villages, were examined.

Table 7.4 AVERAGE COSTS AND RETURNS PER HECTARE FOR UPLAND FIELDS BY INCOME CLASS IN NIGERIA (IN NAIRA)

	Income Class			
	Low	Middle	High	All
Value of Output	99.73	120.44	148.97	125.79
Variable Costs (total)	29.78	28.68	33.88	31.04
Seed	7.64	7.89	5.57	6.91
Fertilizer (total)	1.76	2.04	2.25	2.04
Organic[a]	1.57	1.89	1.99	1.89
Inorganic[b]	.19	.15	.26	.20
Hired Labor	20.38	18.75	26.06	22.08
Gross Margins	69.95	91.76	115.09	94.75
Opportunity Cost of Land[c]	5.01	4.36	4.52	4.61
Labor Use (total hours)[d]	587	694	712	671
Family (hours)	406	430	349	391
Hired (hours)	181	264	363	279
Percent Hired	31	38	51	
Returns to Household Labor, Management, and Capital per Hour	0.16	0.20	0.32	0.23
Number of Field Observations	49	56	68	173

[a]Organic fertilizers were valued at the mean purchase price for each type of manure applied. The average cost was ₦ 0.08 for an equivalent of 160 liters of compound sweepings or manure.

[b]Chemical fertilizer was valued at the current subside price of ₦ 1.60 per cwt. for superphosphate and ₦ 2.00 per cwt. for ammonium sulfate.

[c]All land, regardless of tenure, was valued at the average rental rates observed in each village.

[d]Hours of labor are measured in terms of man-equivalent work hours.

Source: Survey Data

the value of output per hectare, gross margins per hectare, and returns to household labor, management, and capital--indicates a strong direct relationship between productivity and household income status. In contrast to the Sierra Leone results, however, it is also clear that higher income households farmed their upland fields more intensively with respect to both fertilizer and labor. Although fertilizer use (both organic and inorganic) was generally low, high income farmers, on average, applied 27 percent more fertilizer per hectare than low income households. They also applied 21 percent more labor, primarily through hired workers. In comparison, the differential in value of production between extreme income classes was 49 percent.

These relative differences indicate that unless there existed increasing returns to fertilizer and labor, variation in the use of conventional inputs alone does not explain the substantial production gradient. Production function analysis was conducted to examine the contribution of each factor to output variation. To determine whether production relationships differed structurally among income strata, separate functions were fitted to data from each class. Both constant elasticity of substitution (CES) and Cobb-Douglas functional forms were used with the latter giving the best fit.[1] Results are summarized in Table 7.5.

Two findings were particularly important. First, whereas factor MVPs for both land and labor generally increased with income status, fertilizer showed the opposite relationship. This implies that a fertilizer program

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[1] In all cases the elasticities of substitution estimated in the CES functions were found to be not significantly different from unity.

Table 7.5 PRODUCTION ELASTICITIES AND MARGINAL VALUE PRODUCTS ESTIMATED FROM COBB-DOUGLAS PRODUCTION FUNCTIONS FIT TO NIGERIAN UPLAND FARM DATA[a,b]

Income Strata	Model A Fields with Fertilizer[c] Labor (Hours)	Land (Ha)	Fertilizer (N)	Constant	Model B Fields without Fertilizer[d] Labor (Hours)	Land (Ha)	Constant
			(Production Elasticities)				
Low	.388 (0.554)	0.55 (0.550)	.359* (.248)	1.245	.842** (.234)	.184 (.211)	-.856
Middle	.507*** (0.131)	.229** (0.110)	.117** (.064)	1.182	.414* (.296)	.533** (.287)	1.824
High	.690*** (0.150)	.211* (.128)	.116** (.064)	.223	.461*** (.141)	.467** (.138)	1.640
			(Marginal Value Products Calculated at the Mean)				
Low	.055 (.078)	6.16 (61.60)	10.85* (7.47)		.135*** (.038)	13.58 (15.65)	
Middle	.096*** (.025)	37.97** (19.90)	6.89** (3.77)		.60* (.043)	43.90** (23.64)	
High	.139*** (.030)	44.13* (26.77)	4.58** (2.53)		.097*** (.033)	56.06*** (16.56)	
	(Labor)		(Fertilizer)		(Labor)		
Low	788		N3.72		459		
Middle	879		N2.80		562		
High	1037		N5.31		572		

[a]The dependent variable is total harvest value.

[b]Standard errors are in parentheses.

[c]

	R^2 =	n=
Low	.38	25
Middle	.77	31
High	.84	29

[d]

	R^2 =	n=
Low	.68	24
Middle	.79	25
High	.75	39

Source: Survey Data

*Significant at the 10 percent level.

**Significant at the 5 percent level.

***Significant at the 1 percent level..

which concentrated distribution to lower income households would satisfy both equity and output objectives. Second, inspite of the fact that higher income households used substantially more labor per hectare, the estimated MVP to labor on fertilized fields also increased with income status.[1] Since each equation exhibits diminishing returns to labor, this implies that structural differences distinguished the production relationships of the three income classes.[2] These results mean that there were fundamental differences among income strata either in the quality of factors applied or in the techniques of production which were not adequately captured in the conventional production function approach. The possible nature of these structural differences was further examined by means of technical efficiency analysis.

The Measurement of Technical Efficiency

Technical efficiency differentials can be defined as the variation in output across a set of firms using the same combination of inputs which is not caused by differences in technology or by random disturbances. These differentials can be depicted either as neutral displacement about an average production function [Mundlak, 1961] or by deviations from a frontier production function [Timmer, 1970; Farrell, 1957; Shapiro, 1977].

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[1] It should also be noted that for no stratum was the MVP labor significantly different from the market wage (₦ 0.10 per hour for adult males) even at the 15 percent level. Thus no differences in the allocative efficiency of labor use were observed among income groups.

[2] A Chow test applied to test for structural differences in the production functions of the various income strata found that the null hypothesis of structural similarity across income classes could be rejected at the two percent level of significance.

The approach taken in this study has been to identify the relative deviation of field output values about their expected values as estimated by coefficients from an average production function[1] [Matlon and Newman, 1979]. The procedure was in three steps. First, a Cobb-Douglas production function was fit to a sub-set of upland fields characterized by a similar mixture of crops.[2] Because there were multiple observations (fields) per household, it was possible to employ a covariance procedure to remove household effects by including household dummy variables in the estimating equation.[3] Second, using the coefficients of the average unbiased regression, expected production values ($\hat{Y}$) were calculated for each field as a function of the levels of labor, land, and fertilizer actually employed. Third, a technical efficiency index, E, was calculated for each field j as: $E_j = \frac{Y_j - \hat{Y}_j}{\hat{Y}_j}$.

[1]The frontier production function approach is highly sensitive to outlier observations as well as to the effect of management bias. Moreover, while methods can be used to minimize the effects of both problems, when they are applied Timmer [1970] has shown that the resulting efficiency measure yields very similar results to those obtained from the analytically simpler residual procedure based on an average production function.

[2]In order to minimize the effects of crop mix differences while preserving sufficient observations, we selected only those upland fields on which at least 80 percent of total harvest value consisted of millet and sorghum. In all cases, the remaining production consisted of groundnut and/or cowpea.

[3]The resulting function, excluding presentation of the household coefficients, was:

$$\ln Y = \underset{}{2.9290} + \underset{(2.93)}{.2284}\ln X_1 + \underset{(1.47)}{.5768}\ln X_2 + \underset{(4.14)}{.0493}\ln X_3 \quad R^2 = .91 \quad \bar{R}^2 = .83$$
$$\qquad\qquad\qquad\quad (1.07)$$

where Y is the value of output, X_1 is the total man-equivalent hours of labor excluding harvest and crop removal, X_2 is the size of field in hectares, and X_3 is the value of organic and inorganic fertilizers applied. T-values are shown in parentheses.

E_j can be interpreted as the percent by which production (Y_j) on field j deviated from the average level of production ($\hat{Y}_j$) which could be expected given the levels of conventional factor inputs actually applied.

Regression analysis employing E as the dependent variable was then used to identify the individual effects of the most important determinants of technical efficiency. The results of the equation giving the best overall fit, consistent with theoretical considerations and minimizing correlation among independent variables is presented in Table 7.6.[1]

Determinants of Technical Efficiency

Sixteen variables representing factor quality, management practices, and crop mix explained two-thirds of the variation in technical efficiency. Controlling for all other variables, production efficiency was significantly lower in the most densely populated study village, Rogo. That village had a history of more intensive land use unmatched by greater manuring. This result probably reflects lower current soil nutrient status, and is thus consistent with the Sierra Leone findings. Similarly, efficiency was lower though not significantly, on fields held temporarily by the household through rental or pledging arrangements.[2] Even after controlling for observed differences in management practices, both the

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[1]A simple linear functional form was employed in the final estimating equation. Quadradic terms were tested for the timing variables as well as for age head to determine the presence of non-linearity, but in each case estimation precision was reduced.

[2]Goddard [1970] has reported that fear of losing rental rights following manure application often leads to reduced fertility on fields held in rental status for several years. Moreover, farmers prefer to rent or pledge out to other households fields which are of naturally lower fertility and/or which have received least fertilizer in preceding years.

Variable	Units	Coefficient	T value
Constant		-16.45	-0.4
Soil quality proxies:			
Medium Density Village location 1	0,1	-26.52	-1.2
Medium Density Village location	0,1	-53.28	-1.8*
Temporary tenure	0,1	-31.09	-1.4
Years since last fallow	years	1.26	0.7
Labor quality proxies:			
Age of household head	years	.48	0.6
Technical knowledge	score (1-5)	35.27	1.9*
Family field	0,1	50.59	1.9*
Management practices:			
Date planting early millet	weeks	18.12	1.5
Date planting tall sorghum	weeks	-43.29	-2.7***
Date planting late millet	weeks	-6.81	-2.1**
Date of mean first weeding	weeks	-8.40	-2.2**
Percent hours late weeding	%	143.17	2.3**
Percent of dressed seed	%	24.13	1.2
Number of crops per mixture	number	46.26	3.5***
Crop mix effects:			
Percent harvest value early millet	%	-2.59	3.8***
Percent harvest value groundnut	%	-1.75	-0.9
Percent harvest value cowpea	%	-7.57	-3.5***

N = 54 R^2 = .66 R^2 = .50 F = 4.07

*significant at 10% **significant at 5% ***significant at 1%

Source: Survey Data

knowledge of recommended practices and family field variables also had a significant effect on E.[1] The former reflects management differences not specified in the equation but which are correlated with the knowledge of recommendations. The latter is believed to reflect motivational effects (x-efficiency), soil quality variation associated with the decision to locate the household's major grain field, and priority given such fields in the performance of farm operations.

Of particular interest are the highly significant impacts found for the set of management practices. The value of E rapidly declined with delays in planting sorghum and late millet. A similar reduction in productivity accompanied a delay in first weeding and reductions in subsequent weedings. Consistent with earlier studies, the degree of intercropping as reflected in the average number of crops interplanted was also highly significant.[2]

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[1]Each head of household was given a simple test to determine his knowledge of 5 recommended practices concerning the use of chemical fertilizers and pre-planting seed treatment. The technical knowledge variable was defined as the score received [Matlon and Newman, 1979]. With regard to the family field variables, the fields of extended (gandu) households can be divided into two groups: (1) gandu fields farmed in a common effort among all members of thehousehold, and (2) gayauna fields usually worked by a single male in the household. Production from gandu fields accrues to the entire household and typically meets their subsistence needs whereas gayauna production is viewed as a supplementary source of cash or food to the individual worker.

[2]In earlier runs it was found that coefficients on time allocated to both early and late ridging operations showed negative signs and were insignificant. Both variables were dropped from the final equation. The short sorghum data of planting variable was also dropped from the equation due to collinearity with the early millet planting date. Finally, variables reflecting the six most common crop rotations were consistently insignificant and were also excluded.

Technical Efficiency and Farm Incomes

It is clear that technical efficiency differentials among firms is neither a necessary nor sufficient condition to demonstrate cross-firm differences in the skill of farm managers. That inference is valid only if farm managers operate in similar environments, that is, only if they define the same production objectives and face the same set of production choices and similar constraints which are outside the control of the manager.[1] These external variables included not only the natural enviornment, but factor and output markets and other components of the institutional environment as well. Moreover, it is clear that the income, wealth, and liquidity position of the farmer, brought into the cropping season from previous periods, may also determine his access to resources and thus his production and employment strategy.

The relationships between the set of factors found to be determinants of technical efficiency and the income status of the household were examined within this framework to gain insight as to why poorer households were disproportionately represented among the least efficient producers. Further analysis showed that among the sub-set of households included in the efficiency analysis, a significantly greater number of the poorest families were located in the high population village and a significantly greater percent of their land was obtained on rental. Both results indicate that the poorest households may have been farming soils of lower nutrient status. However, the analysis also revealed that lower income farmers consistently planted later than average, conducted their first weeding nearly two weeks

[1] For an elaboration of this point see Hall and Winsten [1959].

later than average, and weeded at less than half the intensity during second and subsequent weedings compared with middle and high income farmers.

Although it is plausible that each practice reflected poor management thereby explaining in part low incomes of the poorest households, an alternative explanation was equally compelling--that poor households were constrained by low food and cash reserves and thus acted out of economic necessity. For example, lower income households short of both cash and seed would be expected to plant somewhat later to ensure the arrival of the rains thereby avoiding the risk of low germination and replanting. The liquidity position of the poor farmer also offers a possible rationale for sub-optimal weeding. An analysis of cash flow patterns showed that the poorest households experienced an acute cash shortage during the months immediately preceding harvest and as a result were under considerable pressure to generate an immediate cash inflow to purchase food grain [Matlon, 1978]. The cash required to make these purchases was obtained primarily through off-farm labor. Labor profiles, summarized in Table 7.7, suggest that the time allocated to off-farm employment by poor farmers may have competed importantly with operations on their own fields during key weeding periods.

Finally, the low liquidity position of the poorest households not only affected the time allocation of their own members, but also their ability to obtain hired labor for timely execution of key tasks. Low income households were at a clear disadvantage in obtaining hired labor for late weeding, employing 56 percent of the level of hired labor per

Table 7.7 AVERAGE HOURS PER WEEK SPENT BY ADULT MALES IN FARM AND OFF-FARM EMPLOYMENT DURING KEY WEEDING PERIODS, BY INCOME CLASS[a,b]

Income Class	Activity	Week After First Planting Rains: 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
		First Weeding					Second and Subsequent Weeding									
Low	Own Farm	21	14	12	16	19	16	15	17	17	15	14	13	7	11	12
	Hired Farm Labor	4	3	3	2	2	3	3	3	2	3	2	2	1	2	1
	Non-Agricultural[c]	3	3	3	2	2	3	2	3	2	2	3	2	2	2	4
	Total	27	19	17	20	23	21	19	23	21	19	19	17	11	15	17
Middle	Own Farm	34	29	18	32	37	37	30	26	24	20	22	24	17	24	22
	Hired Farm Labor	-	1	1	-	-	-	-	-	1	-	-	-	-	-	1
	Non-Agricultural[c]	-	1	1	-	-	1	1	1	-	-	1	1	-	1	1
	Total	35	31	19	33	37	38	31	27	25	20	23	25	17	25	24
High	Own Farm	29	14	15	18	30	29	21	16	16	15	11	8	12	11	17
	Hired Farm Labor	1	1	1	-	1	-	-	-	1	-	-	-	-	-	-
	Non-Agricultural[c]	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-
	Total	30	15	16	19	31	30	25	21	17	15	11	9	13	12	18

[a]Excludes travel time.

[b]There are 126 observations in each income class.

[c]Excludes work on farms of other households.

Source: Survey Data

hectare as middle income households and only 17 percent of the level of high income households.

In a related analysis of labor hiring patterns in Sierra Leone, Franzel [1979] found similar results. Although high income farmers did not necessarily hire more laborers on an annual basis than low or middle income farmers, they were able to hire a greater proportion during the key bottleneck periods when returns to labor were greatest. The ability of higher income households to obtain hired workers during these periods was attributed to cash availability and to the related social status enjoyed by higher income households which gave them preferred access to exchange labor.

In summary, what emerges is a partially circular pattern of causation through which factors caused by low incomes may have importantly constrained the management options of households already in poverty thus reducing their farm productivity. Moreover these results demonstrate that the level of personal income may affect the small farmer's ability to modify current farming systems, as for example through the adoption of an improved technical package, in more pervasive ways than once thought. Previous studies have affirmed that capital shortage can constrain poor farmers from purchasing improved inputs and that low incomes may reduce the willingness of poorer farmers to accept the increased risk or uncertainty associated with improved packages. However, the present findings demonstrate further that income may directly affect both the amount of farm labor available at key points in the cropping cycle as well as the willingness and ability to perform operations at optimal times. It follows that within the present Nigerian environment improved technologies which

require early planting, timely execution of key operations, or substantially increased labor during the immediate pre-harvest period would be expected to achieve smaller yield increments as well as lower rates of adoption among the poorest farmers.

VIII. CHOICE OF TECHNIQUE AND THE DISTRIBUTION OF INCOME IN SIERRA LEONE

The analysis to this point has focussed on identifying patterns of personal income distribution among rural households in Sierra Leone and northern Nigeria and has explored the determinants of those patterns. Because technical change in the rural sectors of both countries has been limited, the preceding analyses have emphasized generally traditional production systems which are currently in widespread use. In this chapter we turn to an evaluation of government policies which attempt to promote more equitable growth by influencing the choice of technique towards more labor intensive production processes. To accomplish this we have drawn on key results of work previously completed by Michigan State researchers in Sierra Leone and integrate them into the broader findings of the present study.[1]

The Choice of Technique Strategy

A general strategy put forward as a means of improving the distribution of income over time is to encourage the expansion of more labor intensive modes of production in both the agricultural and non-agricultural sectors. It is argues that by setting factor prices to more closely reflect domestic resource availability, by adjusting tariff structures to discourage the import of labor displacing capital, and through the selective application of subsidies, economic conditions can be created which will expand employment opportunities for low and middle income workers in smaller-scale more labor intensive sectors.

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[1] See Byerlee et al. [1979], Byerlee et al. [1976], Liedholm and Chuta [1976], Linsenmeyer [1976], and Spencer et al. [1976].

Evidence examined in this study indicate that the strategy may have direct relevance to countries such as Sierra Leone and Nigeria. A review of national income patterns in Chapter II, for example, showed that in both countries substantial income disparities existed between rural and urban sectors and that the gaps had increased substantially during the past decade. Moreover, the analysis of urban incomes in Sierra Leone revealed that the highest average incomes nationally were concentrated among a relatively small urban work force employed in the private, large-scale sector. In contrast, employment profiles for both countries reflected considerable underemployment for workers in the poorest households.

Several questions, however, have arisen over the appropriateness of the "choice of technique" strategy as a means of reducing income inequality. One of these is whether there is in fact an array of alternative techniques in use or potentially available within each sector or sub-sector of the economy. If alternative techniques of production do exist, a second issue is whether there is a conflict between equity and efficiency, that is between the employment generation and output objectives in national planning. Within a static framework, this raises the question of whether more labor intensive production techniques make more efficient use of the scarce factor, capital. Two related issues within the national planning context are whether governmental policies have tended to introduce factor and product market distortions which favor capital intensive technologies, and whether choice of technique can be shown to be sensitive to relative factor and product prices. In a more dynamic framework, there is the question of whether there exists adequate consumer demand for products of labor-intensive sectors, and whether such demand is elastic to changes in income. A further question

regarding consumer demand is whether lower income groups consume more labor-intensive commodities. This is important in determining whether policies which result in a more equitable income distribution will produce multiplier effects which further stimulate employment thereby reinforcing equitable patterns of growth.

A final question is what impact the strategy would have on the interpersonal distribution of incomes between and within sectors. This raises the critical question of whether the poorest rural households would be likely to share the benefits of a labor intensive strategy. Analysis contained in the preceeding chapters has shown that the failure of low income households to undertake select high return enterprises was attributable to the high capital requirements associated with those activities. If follows that the strategy would more likely benefit poor rural households to the extent that considerable additional employment is created for non-members of owner/operator households and to the extent that it is possible to profitably engage in such activities on a small-scale where capital requirements are minimal while pursuing traditional farming activities.

Existence of Multiple Production Techniques

The existence of a range of production techniques can be demonstrated by examining variation in respective output-capital, output-labor, and labor-capital ratios.[1] Drawing on firm data collected in Sierra Leone in

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[1]The output-capital ratio, which shows the output which can be obtained per unit of capital, is used as a measure of the efficiency of the production technique with respect to the scarce factor, capital. The labor-capital ratio is an indicator of labor intensity. Techniques which are both labor intensive (high labor-capital ratio) and which are efficient users of capital (high output-capital ratio) would tend to minimize output-employment conflicts, at least in a static sense. Finally, the output-labor ratio allows a comparison of techniques on the basis of relative labor productivity.

conjunction with the rural household survey,[1] Byerlee et al. [1979] have examined production techniques in the agricultural, agricultural-processing, fishing, and manufacturing sectors. Their analysis revealed a wide range of technologies within each sector marked by substantial variation in capital-labor ratios and in scale of production. An important finding in that analysis was that within each sector, small-scale and more labor intensive processes were consistently associated with higher output-capital ratios. That is, they were more efficient users of capital. These results suggest that it was possible to both promote employment and maximize output through the efficient use of capital using labor-intensive production techniques.

Factor Market Distortions

Since a range of production techniques does exist in Sierra Leone, factor market distortions which influence the choice of technique may have a major impact on the extent of unemployment. Further analysis examined price relationships in capital and labor markets in Sierra Leone as well as distortions stemming from the existing tariff structure, in an effort to identify prevailing factor prices differentials between the small and large-scale sectors of the economy. Available data revealed major dichotomies. Large-scale firms were favored in capital markets as

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[1] The data were collected in three supplemental surveys conducted in 1974-75. Twice-weekly interviews were conducted with 60 rice milling firms, 120 fishing firms and 250 small industrial firms in both rural and urban areas. These data together with secondary data on large-scale industrial production provide an overview of non-farm production techniques nationally.

a result of privileged access to formal institutional sources which extended low cost, highly subsidized loans.[1] In contrast, small-scale firms generally depended on their own finances, on loans from relatives and friends, and on loans extended by traders on purchases, typically at interest rates several times higher than those charged in the formal market.[2]

There was also large variation in wage rates for unskilled labor in Sierra Leone, with the difference again reflecting a dichotomy between small-scale and large-scale sectors. In urban areas, the wage rate for unskilled labor in large-scale firms was nearly double that in small-scale industry. Furthermore the wage rate in rural sectors was on average 55 percent of the wage in urban small-scale sectors. Finally, under the import tariff structure which prevailed during 1974-75, small-scale firms paid substantially higher tariffs on imported inputs than did large-scale firms while receiving considerably less protection against competing imports.[3]

The sensitivity of choice of technique to such market distortions was tested through a combination of linear programming and budget analysis.

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[1] In 1974-75, private banks charged an interest rate of 12 percent on all loans--the maximum allowed by government regulation. Since the rate of inflation at the time was over 15 percent, this actually represents a negative real interest rate.

[2] Allowing for delayed or defaulted repayments, Linsenmeyer [1976] calculated an interest rate of 43 percent for small-scale fisherman. This rate is believed to be generally in line with other informal credit sources.

[3] For example, although tariffs on sewing machine parts (used by small firms) were 36 percent, large-scale clothing firms enjoyed low or zero tariffs on imported items [Liedholm and Chuta, 1976].

Emphasis was placed on measuring the effect of variation in the price of capital through changes in subsidies and tariffs, foreign exchange and interest rates--pricing instruments which are directly influenced by government policy.

Within the agricultural sector, the profitability of using tractors for land preparation was found to be highly sensitive to the rate of subsidy for tractor services. Under existing factor prices which included an 85 percent subsidy for tractor services, mechanical cultivation reduced production costs by ten percent when compared to hand cultivation. However, with the removal of these subsidies, the cost of production using mechanical cultivation was more than double that of hand methods. This was reflected in the optimization analysis by a switch from mechanical to hand cultivation when factor prices were changed to reflect the real cost of capital. Moreover, labor use was almost doubled when opportunity cost prices were used.

A linear programming approach was also used to analyze the choice of technique among rice processing firms [Spencer et al., 1976]. The results indicated that if existing policies were continued (low cost of capital to large mills, overvalued foreign exchange and high rice prices), efficiency in the rice processing sector would dictate that all hand pounding should be eliminated in favor of small and large mills. The employment effect of this transition would be substantial, with over 40,000 full time rural jobs lost. On the other hand, with factor prices reflecting opportunity costs, the amount of hand pounding was only slightly reduced from current levels and large mills were completely eliminated from the solution. In a similar analysis in the fisheries sector Linsenmeyer [1976] showed

that if large-scale firms operating trawlers were charged the same factor prices as small-scale firms, there would be a substantial replacement of large-scale trawlers by small-scale firms. Finally, analysis of the choice of technique in the small-scale manufacturing sector indicated that variation in the interest rate and tariffs generally did not have large effects except in baking and carpentry industries where there was greater variation in factor intensities among techniques [Chuta, 1977].

Effects of Income Distribution on Rural Consumer Demand

In a study of rural consumption patterns in Sierra Leone, King and Byerlee [1978] examined how changes in rural incomes would affect the demand for factors in producing sectors and the locational distribution of these secondary effects. One of the central objectives of that study was to determine whether the demand for labor intensive commodities was income elastic, that is, whether the demand for such products would increase with economic growth. Their analysis was based on an estimation of expenditure elasticities and marginal propensities to consume for households disaggregated according to income status.[1] Estimates of expenditure

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[1] Expenditure elasticities were estimated using a ratio semi-log inverse model which allows the income elasticity to vary by income level and also preserves additivity of the marginal propensity of consume at each income level. The final estimating equation was of the form:

$$C_{ij} = a_i Y_j + b_{1i} Y_j \ln \bar{Y}_j + b_{2i} N_j + b_{3i} \ln S_j + \sum_{i=1}^{8} g_{hi} R_{hj} + u_{ij}$$

where,

C_{ij} = consumption of commodity i by household j,

Y_j = total expenditure of household j,

$\bar{Y}_j$ = per capital expenditure of household j,

N_j = number of people in household j,

elasticities together with labor/capital ratios for specific commodities are shown in Table 8.1.

Analysis showed that 84 percent of marginal expenditures for all rural households were for goods in small-scale labor intensive sectors. An especially important result was that the demand for products from all labor intensive sectors was highly income elastic reflecting strong growth in demand for labor intensive commodities. Moreover, as expected labor requirements per Leone of expenditure at the margin fell at the margin as incomes increased--from 9.2 person hours per Leone among households in the poorest decile to 7.6 hours per Leone of expenditure among tenth decile households. This means that lower income groups did in fact consume a more labor intensive bundle of commodities.

In short, the consumption analysis revealed a deep and expanding demand for labor intensive products which could support the choice of technique strategy. Moreover, growth in the derived demand for labor would be greatest if increments to incomes were concentrated among the poorest rural households.

Importance of Alternative Techniques for the Poorest Rural Households

In view of the range of available technologies, their demonstrated sensitivity to changes in factor and product prices, and given the relatively high income elasticity of demand for labor intensive commodities, a remaining issue is the extent to which removal of market distortions

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S_j = subsistence ratio in household j,

R_{hj} = dummy variable for region h with value 1 if the household is in region h, 0 otherwise.

Table 8.1 OUTPUT-CAPITAL, OUTPUT-LABOR, AND LABOR-CAPITAL RATIOS FOR SELECTED PRODUCTION TECHNIQUES AND INDUSTRIES IN SIERRA LEONE[a]

Industry and Production Technique	Output-Capital	Output-Labor	Labor-Capital
Rice Production			
Hand Cultivation	114.00	.18	637.00
Tractor Cultivation	.16	.06	2.70
Rice Milling			
Hand Pounding	40.90	.06	638.00
Small Steel Cylinder Mills	1.83	1.46	1.25
Small Rubber Roller Mills	.97	1.35	.72
Large Rubber Roller Mills[b]	1.20	10.00	.12
Fisheries			
Canoe 22 ft - Ring Net	8.75	.47	19.90
- Set Net	8.73	.43	17.80
Boat 30 ft - Beach Seine	5.42	.32	16.73
Boat 30 ft - Ring Net	7.66	.37	20.60
Boat 40 ft - Ring Net < 26 HP Eng	8.47	.36	23.80
- Ring Net > 26 HP Eng	5.50	.30	18.20
Large Trawlers	1.51	1.03	1.46
Manufacturing			
Clothing			
Rural, small tailor non-electric sewing machine	8.30	.50	16.60
Rural, small tailor electric sewing machine plus	7.60	.60	12.50
Urban, small tailor electrice sewing and embroidery machine	2.60	.60	4.30
Urban, large clothing factory	1.70	.80	2.20
Baking			
Rural, small mud oven traditional	19.00	.50	38.00
Urban, small peel oven	15.00	1.00	15.40
Urban, small multiple deck oven	3.20	.60	5.30
Urban, small reel oven	4.50	1.00	4.50
Urban, large tunnel oven	2.60	1.00	2.60

[a]Output measured in Leones of value added, capital measured in annual costs at 35 percent opportunity cost and labor in man hours.

Source: Byerlee, Eicher, Liedholm, and Spencer [1979].

to promote small-scale labor intensive production would reduce relative inequality while improving incomes of the poorest rural households. Such income effects depend on three properties of each technology: (1) enterprise profitability, (2) changes in the demand for non-household labor, and (3) the magnitude of fixed and variable costs relative to the investment capacity of low income families. The latter two properties critically determine in what manner and to what extent low income households could be expected to participate in the expansion of small-scale labor intensive enterprises. An examination of firm data representing a range of technologies in both agricultural and non-agricultural sectors provided evidence on each point.

Within agriculture, input-output data was collected describing two modern technologies of rice production--upland rice involving mechanized land preparation, and an inland swamp rice package including improved seeds, fertilizer, water control, and seeds.[1] Budgets for each rice production technology are shown in Table 8.2. Information on two traditional farming systems practices in each area are also provided to serve as a benchmark. The data suggest that increased production costs in both improved systems are likely to pose major constraints to adoption by the poorest households. In spite of an 85 percent subsidy on tractor services, production costs per hectare increased from Le 25 to Le 50 per hectare under mechanical cultivation. Similarly introduction of the biochemical package increased costs more than three-fold to Le 99 per hectare,

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[1]Data for the biochemical technology were drawn from a purposively selected sample of farmers in the Moa Basin where an Integrated Agricultural Development Project (IADP) was established in 1973.

Table 8.2 ENTERPRISE BUDGETS FOR TRADITIONAL AND IMPROVED SYSTEMS OF RICE PRODUCTION IN SIERRA LEONE

	Moa Basin		Bolilands	
	Traditional Swamp	Improved Swamp	Hand Cultivation	Mechanical Cultivation
	(Average per Hectare)			
Output value (Le)	259.35	355.68	151.66	178.09
Total variable costs (Le)[a]	26.92	99.05	25.44	50.14
Land payment	0	1.73	0.74	5.19
Seed	10.87	12.60	11.12	9.39
Fertilizer	0	3.71	1.98	2.96
Mechanical Service[a]	0	0	0	16.80
Hired labor	11.61	59.03	7.66	7.66
Others	0	5.43	0	0
Interest	4.45	16.55	4.20	8.40
Gross margins				
Per hectare (Le)	232.43	256.63	126.22	127.95
Per hour of family labor (Le)	0.13	0.10	0.18	0.34
Per hour of family labor with unsubsidized costs	0.13	0.09	0.18	0.06
Labor (total hours)	1817	3411	783	477
Family	1721	2779	667	378
Hired	96	632	116	99

[a]Includes 85 percent subsidy.

Source: Spencer and Byerlee [1976].

of which 72 percent represented payments to hired labor. To put these figures into perspective it is useful to recall that the mean annual per capita incomes of the poorest 30 percent of households was only Le 30.

Furthermore, there is little indication that profit levels would warrant widespread adoption of either improved technology. Due to increased costs, returns per hectare of improved swamp rice were only marginally greater than under traditional swamp rice. And since the biochemical package required substantially greater land--due to improved land preparation and larger harvests--returns per hour were in fact lower than in the traditional system. The data also show that returns to land in the mechanized system were nearly identical to traditional systems when an 85 percent subsidy on tractor costs is included, while returns to labor were nearly doubled. After removing the effect of the subsidy, however, returns to both factors in the mechanized system were substantially below the levels obtained through hand cultivation.

It is also important to note that labor inputs per hectare fell by about 40 percent under mechanized cultivation as farmers substituted capital for labor in land preparation activities. However, because land was relatively abundant in the Bolilands area, the substitution permitted an expanded area to be cultivated. For example, the average size farm for farmers employing only hand cultivation was 3.4 hectares compared with 5.1 hectares for those preparing their land mechanically. Thus, while the tractorized system was labor saving, it was not necessarily labor displacing since aggregate demand for labor increased in both weeding and harvest activities.

Turning to the industrial sector, it was found that although small-scale firms used far more labor per unit of capital than their large-scale competitors, employment per firm was nevertheless generally small and typically limited to members of the proprietor's family. For example, among small-scale industry firms in communities with less than 2,000 population, the average number of workers per firm was only 1.6, including the owner-operator [Liedholm and Chuta, 1976]. Average employment per firm rose to 2.4 workers in communities between 2,000-20,000 population, and was still only 3.5 in urban areas. These figures underline the very minor potential of increasing hired labor earnings through the expansion of small-scale industry, particularly in rural areas.

Given the limited capacity of small-scale firms to generate additional hired labor employment, it is important to determine whether there is sufficient variation in the capital requirements of alternative techniques so as to enable poor farm households themselves to diversify into non-farm activities. An analysis of costs and returns of the most common small-scale enterprises--tailoring, carpentry, and blacksmithing--found that although the scale of operation and thus initial capital requirements were lowest in the smallest communities in which firms were operating, capital requirements were nevertheless substantial even in the smallest rural areas. For example, Table 8.3 shows that among these enterprises, the average capital stock was about Le 180 with annual user costs of Le 39 in communities of less than 2,000.

Further analysis of the sources of funds used to acquire entry capital for these rural industries revealed that the rural informal capital

Table 8.3 SELECTED BUDGET ITEMS FOR THREE SMALL-SCALE RURAL INDUSTRIES BY SIZE OF LOCALITY IN SIERRA LEONE (IN LE)

	Tailoring		Carpentry		Blacksmithing	
	Population		Population		Population	
	<2,000	2,000-20,000	<2,000	2,000-20,000	<2,000	2,000-20,000
Gross output	213	604	78	3511	246	1301
Materials and service inputs	11	174	7	224	6	220
Value added	203	431	70	1270	238	1141
Value of capital stock	185	283	175	849	180	839
Annual user cost of capital	39	62	37	168	38	216

Source: Liedholm and Chuta [1976].

market had little potential to ease the entry burden. Within rural communities, loans provided less than 6 percent of the initial capital, with 38 percent obtained out of savings from agriculture, and 27 percent taken from savings out of previous trade or business [Liedholm and Chuta, 1976]. That is, the data strongly suggest that diversification into rural non-farm enterprises follows a sequence beginning with surplus agricultural production followed by subsequent reinvestment of profits into an expanded scale of operations. This sequence, and the magnitude of initial investments, effectively exclude the participation of low income families.

An analysis of small-scale marine fishing enterprises revealed similar constraints limiting entry of low income households. While there was a wide range in the acquisition cost of equipment depending on the type of fishing vessel, nets and propulsion equipment, the least expensive capital stock per firm still amounted to Le 57 representing an annual capital user cost of Le 35 [Linsenmeyer, 1976]. Although, loan capital was a more important source of initial capital, providing 47 percent of initial investments, 18 percent was still derived from agricultural savings and 35 percent from profits generated in other non-farm activities. This again suggests a sequential phasing of entry into fishing enterprises. Finally, because the average small-scale fishing firm employed less than two non-family workers, the fishing sector would also generate little employment beyond members of the proprietor's family.

Implications

This chapter has reviewed evidence from Sierra Leone concerning the distributional implications of promoting employment through the encouragement

of more labor intensive techniques of production. Results from analyses of both demand and supply relationships in several sectors of the economy indicated that there was considerable scope for the expansion of small-scale, labor intensive processes. However, the evidence also suggested that the potential of the labor intensive strategy and its distributional implications varied importantly by sector. Within agriculture it was seen that the only improved production technique examined which increased the demand for labor (the biochemical swamp rice package in Sierra Leone) was not sufficiently profitable to warrant general adoption. Similarly, in the rice processing sector traditional techniques were generally superior to larger more capital intensive processes both in terms of employment and profitability, particularly when factors were priced at their respective opportunity costs. Within both of these sectors it was clear that the removal of factor market distortions would help prevent reductions in employment and incomes for the poorest rural households. In short, while improved production techniques which would improve the distribution of rural incomes were not available in either sector, policies could be structured to prevent an increase in inequality by protecting the viability of efficient traditional practices.

Analysis of choice of technique in the fishing and small-scale industry sectors produced more problematic results. Although smaller-scale labor intensive techniques were economically more efficient within both sectors, the distributional effects of improving price relationships for such firms were mixed. Entry costs associated with even the most labor intensive firms were substantial compared with the investment capacity of lower income rural households. Moreover, employment per firm was not only small, but limited almost entirely to family members.

Thus within both the fishing and small-scale industry sectors, the removal of distortions in factor and product markets would probably be beneficial both from the point of view of national output, and as a means of reducing rural-urban disparities and disparities within urban areas. However, unless access to loan capital was substantially increased for poorer households, or entry costs substantially decreased, the benefits from such policy adjustments would probably be concentrated among middle and particularly high income rural households. Thus rather than reducing rural inequality, it is quite possible that the strategy would increase relative inequality within rural areas while leaving the incidence of absolute poverty largely unaffected.

IX. SUMMARY AND POLICY IMPLICATIONS

Objectives and Organization of the Research

This study arose out of the growing concern among both national planners and external donors with the effects of development programs on the inter-personal distribution of income. The relatively recent interest in distribution reflects an awareness that the absolute income gap separating the rich and poor has widened substantially in all but a few developing countries during the past two decades. However, in spite of national commitments towards more broadly based growth, efforts to reduce inequality have been hindered by insufficient knowledge of how to design policies which ensure broad participation, how to implement them, and how to measure their impact. Underlying these policy questions is a general paucity of information on incomes, on the occupational and demographic characteristics of the poor, and on how the poor respond to and are affected by alternative development policies.

Among the developing areas least is known about the size distribution and structure of personal incomes in Africa. The available information tend to be highly aggregated and have been used primarily to estimate national averages and, in a few instances, to draw comparisons among regions or industrial categories. In a very few cases are data available to examine the inter-personal distribution directly. Moreover, information is almost exclusively limited to the modern urban sector. The present study was designed to partially fill this knowledge gap through a detailed analysis of rural incomes in the West African countries of Sierra Leone and Nigeria.

Four characteristics of the study areas importantly influenced the approach taken in this report. First, West Africa is generally characterized by relatively low man/land ratios, and, as a result, landlessness is uncommon. Hence the rural poor are generally small farmers with typically secure land tenure. Second, only minor technological change has occurred in the agricultural sectors of most West African countries. Thus there is very limited and typically highly localized experience on which to conduct an ex post analysis of the impacts of technological change. However, because investment in physical and biological research in the area is now undergoing rapid expansion there is an urgent need to identify the constraints limiting production among low income farmers thereby contributing in the ex ante design of more appropriate interventions. Third, with few exceptions, most West African countries are characterized by incomes and institutional and infrastructural development generally below levels of most developing countries in Latin America or Asia. Fourth, as mentioned, the information base on rural incomes at the household level is particularly deficient.

Experience in countries which have witnessed the spread of improved biochemical technologies has shown that if successful adoption requires increased use of factors which are directly related to current income, such as human or physical capital, or if access to modern inputs is influenced by institutional systems, a concentrated traditional distribution will both retard the rate of adoption and reinforce existing inequalities. Therefore an important assumption upon which this research was based is that if improved production systems are to be developed for

the rural poor, a better understanding of the current distribution of income is essential.

The approach taken in this research has been first, to examine how inter-household differences in resource endowment, resource use, and resource productivity effect the distribution of personal incomes; and second, to identify causal factors underlying variation in resource endowment, use, and productivity. Through the analysis of these relationships, we have attempted to construct profiles of households--including both structural and behavioral characteristics--at various levels of income. Particular emphasis was placed on illuminating the circumstances of the poorest rural households in both case studies.

The study was organized into four major parts:

First, the structure of incomes in Sierra Leone and in a selected area of northern Nigeria was analyzed through a comparison of the levels, sources, and distribution of income among rural households. Demographic variables were also examined to determine the effect of factors related to family size and composition on the incidence of low incomes.

Second, patterns of resource endowment and levels of resource use were examined to determine the relationship between conventional factor use and incomes.

Third, causes of variation in factor returns were analyzed for both farm and non-farm enterprises and among income strata. In particular factors affecting enterprise choice as well as the effect of enterprise choice on household incomes were examined to determine the extent to which low income producers were constrained to low returns activities. Variation in the productivity of farming systems was also analyzed in an

effort to identify how the economic circumstances of low income households may limit farm productivity within traditional farming systems and to derive implications for the design of more appropriate technologies.

Fourth, a range of currently available technologies in several farm and non-farm enterprises was analyzed to determine the likely impacts of development policies which pursue equitable growth through the promotion of labor intensive modes of production. Of particular interest in that analysis was whether policies affecting choice of technique were likely to be effective in improving the incomes of rural households now in poverty.

Key Findings and Implications for Policy

The Degree of Rural Inequality

For policy purposes it is convenient to distinguish between relative inequality and absolute poverty, and between current patterns of distribution and future trends. Income profiles constructed in both Sierra Leone and Nigeria showed that incomes were not highly concentrated but rather displayed fairly equitable distributions. In Sierra Leone, for example, the Gini coefficient calculated on income per capita was .38, and in Nigeria it was only .28. Given the production technologies available in both areas of West Africa, existing farming systems were not sufficiently profitable, capital intensive, or technically complex to produce wide income differentials. Further, the continued availability of surplus land combined with relatively egalitarian land tenure system have contributed to the maintenance of income equality.

In an analysis of the components of inequality in Sierra Leone, an important finding was that inspite of wide inter-regional income differences, approximately 80 percent of rural inequality was caused by income variation at the village level. That is, the major determinants of inequality clearly operate at the village level. This suggests that policies directed at reducing rural inequality through the regional reallocation of development investment will have negligible impact unless the causes of intra-village disparities are effectively attacked as well.

A second important finding bearing on the nature of rural inequality was that in both case studies inequality at the village level was directly associated with population pressure and improved road access. Although the underlying mechanisms were not clear, some evidence suggested that improved transportation and a more concentrated population resulted in greater integration into the market economy with consequent changes in the structure of demand. This in turn increased non-farm and cash cropping opportunities which could be most effectively exploited by higher income households with greater investment capacity.

The Incidence of Absolute Poverty

In spite of the comparatively modest range over which incomes varied, because average incomes were not greatly in excess of minimum subsistence requirements, a serious degree of absolute impoverishment occurred among the poorest 30 percent of households in both areas. Moreover, the incidence of absolute poverty was found to be concentrated in the less humid portions of Sierra Leone marked by high population density. From a policy perspective, however, the problem of absolute poverty is not best addressed within a

framework of relative inequality; that is, through policies focussed on redistributing assets or income. Rather the major problem is the generally low level of income overall and the limited capacity of those now in poverty to improve their incomes given available resources and production technologies.

The Causes of Poverty

A range of income determinants was examined in an effort to identify factors causing the incidence of low incomes. An important result of that analysis was that no single factor explained the major part of income variation. For example, while lower income households farmed somewhat smaller holdings, the correlation between land size and income was generally not high. This was largely due to a significant inverse relationship between land and non-farm earnings, and due to wide variation in land productivity. It was important, however, that the correlation between land and income was consistently highest in areas of greater population density and where the land market was more commercialized. This suggests that as population pressure increases and as the view of land as an economic factor of production becomes more general, access to land may become a more important determinant of income and a possible source of increased inequality.

Overall employment levels were low in both areas and clearly contributed to low mean incomes, furthermore, hours of employment tended to be lowest among workers in the poorest households, even during peak labor periods. More important than the low levels of employment, however, was the consistently lower productivity of poorer workers when they were employed.

An analysis of productivity differentials found that a complex set of factors integrally related to poverty level incomes combined to limit the management options of households already in poverty thereby reducing their production potential. For example, data from both countries showed that a lack of capital effectively excluded the poorest households from participating in the most profitable rural non-farm enterprises. Evidence of a poverty-trap situation was perhaps clearest in the analysis of the Nigerian farming systems. Constrained by a lack of calories and cash during critical farming periods, low income workers diverted a substantial proportion of their labor to hired wage employment in an effort to generate a constant cash inflow. As a result, operations on their own farms were performed in an untimely manner and at sub-optimal levels. Exogenous factors contributing to low farm productivity were also identified. In both Sierra Leone and Nigeria, for example, returns to both land and labor were significantly lower in villages with above average population densities. This points to a chronic future decline in farm productivity and incomes given current technologies.

Finally, an analysis of the relationship between demographic factors and income revealed that a significant proportion of households in poverty were characterized by extremely unfavorable dependency ratios reflecting particular stages in household growth and development. The finding that life-cycle factors importantly contribute to poverty incidence emphasises the limits within which conventional rural development policies can improve the incomes of the poorest households.

Trends Toward Increasing Inequality

In contrast to current patterns of relative income equality, several indicators identified in the study point toward the emergence of widening income disparities in the future. These include both structural changes in the location and composition of employment which are associated with growth, as well as several pre-conditions for the emergence of agricultural dualism. For example, the study found that increasing inequality was associated with the emergence of market towns and urban centers in both countries. As urbanization proceeds, unless fundamental structural changes occur, national inequality is almost certain to increase.

Relationships on both the demand and supply side of rural non-farm enterprises also point toward widening inequalities within rural areas. Since the demand for non-food goods produced in rural areas is highly income elastic, improved rural incomes will generate increasing demand for such commodities. Although a range of techniques was observed permitting some choice of relative capital or labor intensity, initial capital costs and variable costs associated with even the least capital intensive non-farm enterprises are gnerally high compared to the incomes of the poorest rural households. While these costs do not completely prohibit entry of low income producers into such non-farm enterprises, they do effectively limit their scale of operation. This ensures that the greatest share of future growth in demand for rural non-food items will be met by higher income producers. Increased capital costs observed for two "improved" farm technologies introduced in Sierra Leone will produce similarly biased participation with respect to farm production.

In the Nigerian study it was also observed that village leaders had preferred access to extension assistance and used their positions of influence to divert government supplied farm inputs for their personal use. As more profitable crop production technologies are developed which increase returns to extension and investment in modern inputs, it is clear that such patterns of privilege will lead to greater inequality.

Finally, the Nigerian data also revealed that lower income families were critically dependent upon high income households both for peak season employment and for the purchase of grains during the pre-harvest period. This suggests that if an income-based class structure were to emerge with a parallel decline in current communal support institutions--as has been observed elsewhere in West Africa [Norman et al., 1979; Harriss, 1979]--at least some of the pre-conditions for an exploitive system of exchange already exist at the village level.

Policy Options For Equitable Rural Development

The challenge for policy makers then is to devise strategies which not only raise the profitability of rural enterprises, but which also ensure the participation of low income households thereby restricting the tendency towards dualism. Since the incomes of the rural poor are primarily generated from farming, on their own farms and as hired laborers, primary emphasis must be placed on strategies which increase the demand for and returns to labor in agriculture, with particular emphasis on disadvantaged regions.

Perhaps the most basic means of increasing incomes while promoting broad benefit incidence is through the development of improved crop production packages which are compatable with the factor endowments of low

income producers. Since a disproportionate number of the poorest households in less humid areas either specialize in grain production (Sierra Leone) or are net grain purchasers (Nigeria), priority should be given to the improvement of food grain technologies suited to low-rainfall conditions. In Sierra Leone priority should be given to upland rice and fundi, and in Nigeria to the millets and sorghum.

Moreover, in order to permit broad patterns of adoption, the technical package should economize on those factors most limiting for low income producers--capital, peak period calories, and, quite possibly, management. It was clear that both improved technologies examined in the Sierra Leone context were incompatible with high adoption rates among poor farmers. More incremental "minimum input" packages with a credit component offer an alternative approach. Since labor required in weeding and to some extent planting tend to be the primary constraints of production, more modest technologies which conserve on and increase returns to peak period labor should be given priority. Improved seeds which do not require large inputs of complementary factors such as land preparation, water control, or weeding may affect this by increasing output and labor use at other than peak seasons. Chemical inputs such as fertilizer and herbicides may also be appropriate if provided at low cost and with assured access by low income producers.

It is particularly important in the design of such packages that the special circumstances of low income households be explicitly recognized. An analysis of the Nigerian grain production system showed that personal income profoundly affects the small farmer's ability to modify existing practices. Previous studies have repeatedly affirmed that low incomes

directly affect the ability of poor farmers to invest in new technologies as well as the poor farmer's willingness to accept the increased risk or uncertainty attendant to adoption. But in addition, the present analysis has shown that low incomes and limited liquidity create a poverty trap situation which may restrict both the amount of labor available at key points in the cropping cycle, and the farmer's capacity to perform operations at optimal times. Thus within the circumstances of the Nigerian environment, it was concluded that improved technologies which require early planting, timely execution of key operations, or substantially increased labor during the immediate pre-harvest period would achieve lower yield increments and lower rates of adoption among poorer households. One means of breaking the circularity of poverty thereby promoting proper use of inputs would be to add a consumption credit component to input packages. This could both add to the energy available to low income workers while reducing the time spent in off-farm labor.[1]

A second general policy area which may affect the degree of equity in both rural and urban areas is pricing. Factor price distortions caused by existing tariff structures, overvalued exchange rates and by fragmented capital markets have created a distinct bias in favor of capital intensive

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[1]To be economic, of course, it is clear that the returns to proper input use (improved timeliness, etc.) would have to be at least equal to the foregone earnings in off-farm employment. An additional benefit of adding a consumption loan component would be to reduce the immediate resale of inputs received on credit. For example, low income farmers (farmers in the poorest quintile) in the Nigerian sample sold 33 percent of all fertilizer received through government extension programs [Matlon, 1978]. This compared with less than 10 percent for all higher income households. Moreover, analysis showed that while it was profitable for poor farmers to sell the subsidized fertilizer at market prices, the marginal return to actual field use was several times greater than the profit margin.

production technologies thereby restricting employment. Within agriculture, potentially labor displacing mechanization schemes which would not be economically viable in the absence of the price and subsidy distortions, are examples of the type of intervention encouraged by such policies. Similar price policy impacts were observed within the Sierra Leone rice processing and rural non-farm sectors. In both sectors existing policies tended to restrict the growth of small-scale and more labor intensive enterprises which are generally located in rural areas in favor of more capital intensive, large-scale, and urban based firms.

It is important to note, however, that the equity effect of removing price distortions within the fishing and rural small-scale industry sectors is mixed. Incomes of rural households engaged in such enterprises would increase at the expense of generally higher income urban workers. Although this would reduce rural-urban income disparities and improve the overall national distribution, since these rural firms employ few hired laborers, little additional employment for workers from low income households would be created. Thus unless initial capital costs were substantially reduced, it is likely that very little benefit would accrue to households now in absolute poverty.

With this qualification, public action to bring factor prices more into line with their opportunity costs constitutes an important step in creating conditions conducive to more equitable growth. A broad set of individual policy adjustments could be considered: (1) interest rates charged by formal lending institutions should be raised; (2) formal lending operations should be reoriented to perform a saving function for small-scale producers in rural areas; (3) exchange rates should reflect foreign exchange

and capital scarcity; (4) tariff structures should be modified to encourage the importation of inputs which are complementary to labor intensive techniques of production; (5) urban wages in the public and large private sectors should be adjusted to better reflect labor scarcity by skill type; and (6) export taxes on labor intensive agricultural export crops should be removed. While these suggestions are hardly new, they do constitute the kind of comprehensive, programatic approach which, if implemented, could affect future patterns of growth.

Other priority areas for government action involve the regional allocation of infrastructural investment in the transport, education, and health areas. In both Sierra Leone and Nigeria such investments should be concentrated in poorer northern areas. Moreover, they should involve to the extent possible labor intensive approaches in the construction stages to absorb surplus dry season labor.

Finally, it must be recognized that obstacles to ensuring broad participation in programs of development are not only economic and technical in nature, but also institutional. While efforts to diffuse decision making in both the design and implementation of projects down to the village level may reduce biases introduced at the national or district levels, substantial problems may nevertheless remain. Although existing village political systems can provide a means to facilitate greater involvement in village level programs, it should not be automatically assumed that the traditional leadership will, in fact, represent the interests of all classes. The record on this issue is not yet clear in much of West Africa, but it is likely that with greater commercialization, village political and economic

institutions will become less egalitarian. In order to minimize abuses which may occur regarding access to development programs, the roles played by traditional local leaders in implementing interventions at the village level must be better understood. Ultimately, it may be necessary to promote the formation of alternative village institutions which mobilize wider segments of the rural population and which serve a broader range of interests.

APPENDIX A

MATHEMATICAL DEFINITION OF MEASURES OF DISTRIBUTION:

1. Coefficient of Variation

$$\frac{v}{u} \tag{1}$$

2. Standard Deviation of the Natural Logarithm of Income

$$\int_0^{\bar{y}} \left[\log \left(\frac{y}{u^*}\right)\right]^2 f(y)\, dy \tag{2}$$

3. Gini Coefficient

$$(1/2\, n^2 u) \sum_{i=1}^{n} \sum_{j=1}^{n} |y_i - y_j| \tag{3}$$

where,
- v = standard deviation of income,
- u = mean income,
- u^* = harmonic mean of income,
- y = an income observation,
- y_i = income of observation i,
- y_j = income of all other observations j,
- n^j = number of observations.

MATHEMATICAL DEFINITION OF DECOMPOSITION METHODS:

1. Decomposition of the Log Variance of Income:

The basic log variance (V) formula is:

$$V = \frac{1}{N} \sum_{i=1}^{N} (\log y_i - \log Y)^2 \tag{4}$$

where,
- y_i = income of household i,
- Y = average income,
- N = total number of households in the sample.

Decomposing the log variance into g regions:

$$V = \sum_{g=1}^{N} \frac{N_g}{N} (\log Y_g - \log Y)^2 + \sum_{g=1}^{N} \frac{N_g}{N} [\Sigma f_i (\log y_i - \log Y)^2] \quad (5)$$

where,

$f_i = \frac{i}{N_g}$ (if i is an income class, then f_i is the proportion of that class in region g.)

Note that the first term on the right hand side is "between" region variance, and the second term is the "within" region variance. The proportional contribution of each is expressed simply as a percentage of V.

2. Decomposition of the Gini Coefficient[1]:

$$G = \Sigma \Theta_j G_j + \sum_{i>j} \phi_i \phi_j \left(\frac{D_{ij}}{m}\right) \quad (6)$$

where,

G = Gini coefficient for the entire sample,
Θ_j = income share for region j,
G_j = Gini coefficient in region j,
$\phi_i \phi_j$ = population shares for regions i and j,
m = average income of the sample, and

$$D_{ij} = (f_i - f_i)' (2C - I) Y (f_i - f_j) \quad (7)$$

where,

f_i, f_j = population share in each income class within region i,j,
C = a matrix with ones on and below the diagonal with zeros elsewhere, and
I = an identity matrix.

Note that in equation (6) the first term on the right hand side measures the "within" region inequality and the second term measures "between" region inequality.

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[1]Taken from Mangahas, M. 1975. "Income Inequality in the Philippines: A Decomposition Analysis, JERC and CAMA." Income Distribution Employment and Economic Development in Southeast and East Asia. Tokyo, 1975.

3. Decomposition of the Thiel Index[1]:

$$\sum_{i=1}^{N} y_i \log \frac{y_i}{1/N} = \sum_{g=1}^{G} Y_g \log \frac{Y_g}{N_g/N} + \sum_{g=1}^{G} Y_g \left[\sum \frac{y_i}{Y_g} \log \frac{y_i/Y_g}{1/N_g}\right] \quad (8)$$

where,

N = number of households,
y_i = income share of household i,
G = number of localities,
Y_g = income share of locality g, and
N_g = number of households in locality g.

The first term on the right hand side expresses inequality due to differences between locality, and the second term expresses the contribution of within locality inequality.

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[1] From H. Thiel, Economics and Information Theory, Chapter 4.

APPENDIX B

SUPPLEMENTARY DATA ON URBAN INCOMES

Table B.1 SOCIO-ECONOMIC CHARACTERISTICS OF URBAN HOUSEHOLDS IN SIERRA LEONE BY INCOME STRATA

Income Strata	House-hold Size	Percentage of Persons: 0-4	5-9	10-14	15-64	65+	Depen-dency Ratio	Percent Household Heads Educated At: Unedu-cated	Primary	Secondary	Superior	Percent Household Heads Employed In: Gov't	Large Private	Small Private	Self	Appren-tice	Unemployed
Decile 1	5.82	14	18	6	62	0	.38	85.3	8.8	0.0	5.9	38.2	2.9	5.9	11.8	5.9	35.3
Tercile 1	6.60	15	20	12	52	1	.48	85.3	10.8	3.3	2.9	52.1	9.1	2.9	14.0	4.0	17.9
Tercile 2	5.26	16	13	10	60	0	.40	61.6	13.2	2.9	2.9	50.0	11.1	7.2	19.9	3.2	8.7
Tercile 3	3.26	7	8	7	78	-	.22	72.3	10.9	5.9	5.9	62.5	12.5	2.1	16.6	0.0	6.3
Decile 10	3.87	4	7	7	82	0	.18	58.8	8.8	8.8	23.5	59.4	15.6	0.0	18.8	0.0	6.3
TOTAL	5.07	14	15	10	60	1	.40	79.0	11.8	3.0	6.2	54.3	10.9	4.3	17.1	2.5	10.9

[a]Includes firms with more than 50 employees.

Source: Survey Data

Table B.2 PER CAPITA INCOMES OF URBAN HOUSEHOLDS IN SIERRA LEONE BY SECTOR OF EMPLOYMENT AND LOCATION

Sector	Freetown	Kono	Bo, Kenema, Maken	Rural Towns	All
Government	234.36	280.80	195.36	181.56	217.56
Large Private[a]	542.88	169.92	161.40	97.92	261.00
Small Private	141.72	240.00	51.72	121.92	129.48
Self-Employed	230.04	282.84	118.92	178.60	222.84
Unemployed	169.08	104.88	39.12	115.20	127.44
Apprentice	108.84	-	84.00	-	99.48
ALL	237.48	221.16	157.32	180.84	207.00

[a]Includes firms with more than 50 employees.

Source: Survey Data

Table B.3 THE DISTRIBUTION OF INCOME BY SECTOR OF EMPLOYMENT IN URBAN SIERRA LEONE

Per Capita Income Range (Le)	Government	Large Private[a]	Small Private	Self-Employed	Apprentice	Unemployed	All
	(Percent of Households in Each Income Strata)						
<25	4.0	0	0	3.6	25.0	34.3	7.1
25 - 74	15.4	22.9	21.4	14.5	12.5	11.4	15.8
75 - 124	26.3	17.1	35.7	25.5	25.0	22.9	25.2
125 - 174	16.0	17.1	35.7	14.5	12.5	8.6	15.8
175 - 224	6.3	8.6	0	12.7	25.0	8.6	8.1
225 - 274	5.7	11.4	0	7.3	0	2.9	5.9
275 - 324	6.3	2.9	0	3.6	0	2.9	4.7
325 - 374	4.0	5.7	7.1	5.5	0	0	4.0
375 - 424	2.9	2.9	0	0	0	0	7.9
+424	13.1	11.5	0	12.7	0	6.6	11.5
	100	100	100	100	100	100	100

[a]Includes firms with more than 50 employees.

Source: Survey Data

Table B.4 AVERAGE PER CAPITA INCOMES AMONG URBAN HOUSEHOLDS BY LEVEL OF EDUCATION, SECTOR OF EMPLOYMENT AND URBAN AREA IN SIERRA LEONE

	Educational Level of Head				
	Uneducated	Primary	Secondary	Superior	All
Sector of Employment					
Government	198.24	218.64	314.40	372.00	217.68
Large Private[a]	165.50	114.12	1606.44	385.68	261.12
Small Private	109.56	248.52	-	-	129.48
Self Employed	219.48	204.24	174.84	402.00	222.84
Unemployed	107.76	88.92	-	855.96	127.44
Apprentice	113.76	0.0	-	-	99.48
Urban Area					
Freetown	198.84	209.88	745.00	489.60	237.48
Kono	219.48	180.72	252.60	402.00	221.16
Bo, Kenema, Makeni	126.84	172.44	135.72	341.76	157.32
Rural Towns	183.36	169.92	165.60	173.04	180.84
ALL	183.84	189.48	516.00	387.72	207.00

[a]Includes firms with more than 50 employees.

Source: Survey Data

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